

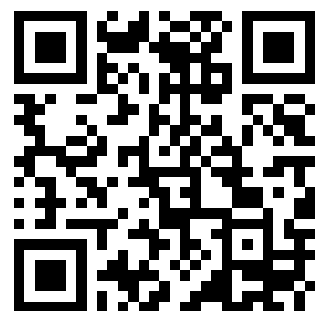
**INDUSTRIAL ARTS AND
VOCATIONAL EDUCATION**

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**Bruce's
1930 School Shop Annual**

**Industrial-Arts and Vocational
Education**

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**Bruce's
1930 School Shop Annual**

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Industrial-Arts and Vocational Education

JOHN J. METZ, Editor



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DEDICATED TO
THE THOUSANDS OF INSTRUCTORS, SUPERVISORS, AND VOCATIONAL DIRECTORS WHO ARE TODAY SHAPING THE LIVES OF THE MEN OF TOMORROW

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Introduction

UNDER the new title, BRUCE'S SCHOOL SHOP ANNUAL is entering its third year of service. Measured by that one word "service," the ANNUAL has fully earned its place. The splendid acceptance which has been accorded it by teachers, supervisors, principals, directors, and superintendents, confirms us in the belief that we have been successful in making the ANNUAL an encyclopedia of useful knowledge on the planning and equipping of school shops.

The 1928 and 1929 editions were especially devoted to the problems of shop planning and equipping. The wealth of material embodied in these two editions showed what had been done in the way of providing for the teaching of woodworking, metal working, auto mechanics, drafting, sheet metal, electricity, printing, and general shop and home mechanics in elementary, junior high, senior high, technical-high and full-time vocational, and part-time vocational schools, in various parts of the United States.

The 1930 edition contains all of the foregoing, but to make it still more helpful, sections on outlines of courses, and on the care and storage of equipment and supplies, have been added. Because of the present great interest in junior high schools the country over, most of the outlines offered have been confined to the junior-high-school level. It is quite obvious, of course, that no two instructors would entirely agree on any outline of study. The outlines presented, however, are definitely planned, so that with proper experimentation, changes, and additions they can be made into a vital, workable basis for a worth-while offering to the youth of our land.

Probably the most useful new offering which the 1930 edition of BRUCE'S SCHOOL SHOP ANNUAL is presenting to its readers, is the description of the organization of industrial-arts and vocational education in typical cities of various sizes. For this purpose, cities with 18,000, 45,000, 300,000, and 500,000 population respectively have been chosen. These descriptions of systems that are functioning, written by the men who are responsible for their successful operation, furnish an overview of well-rounded programs that are engaged in the work of disseminating industrial-arts and vocational education.

To the section which contained the educational directory and the list of teacher-training schools, has been added a roster of industrial-arts and vocational teacher organizations.

Our sincere gratitude is expressed to the city supervisors who so generously supplied us with layouts, descriptive matter, and illustrations; to Mr. Frank Cushman of the Federal Board for Vocational Education; and to the many state supervisors from the United States and Canada who have furnished material for the section on the progress of industrial-arts and vocational education for the year 1929.

Equipped then, with as much helpful material as we could encompass in a volume of the size of BRUCE'S SCHOOL SHOP ANNUAL, we are launching the 1930 edition with the hope that it will be very useful, and that it will increase the large circle of friends which its predecessors have made.

JOHN J. METZ

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Progress in Vocational Education

Frank Cushman, Chief, Industrial Education Service, Federal Board for Vocational Education

The year 1929 has witnessed a consistent and healthy growth in the program of vocational education throughout the country. This program, initiated in 1917 as a result of the passage by the Congress of the United States of the Smith-Hughes Act, is now well into its second decade of development.

Evidences of growth are found (1) in the increasing expenditures of state and local funds for approved forms of work; (2) in the increased ability of the states to apply their allotments for purposes for which provisions are made in their official plans; (3) in the constantly increasing number of individuals served, as shown by large enrollment figures; and (4) by the enactment of the Seventieth Congress of (a) the George-Reed Act, authorizing additional federal appropriations for agriculture and home economics, and (b) the Vocational Rehabilitation Act to provide for the vocational rehabilitation of disabled residents of the District of Columbia.

For the year 1925-26, the ratio of state and local funds per federal dollar expended was \$2.50; for 1926-27, \$2.65; for 1927-28, \$2.77; and for the year 1928-29, \$2.99. The steady increase in this ratio indicates that the states and local communities are sufficiently interested in the development of vocational education to expend far more than is required to match the federal appropriations for the types of vocational schools and classes which conform to the standards of approved state plans. The ratio of \$2.99 of state and local money for each dollar of federal money used for the salaries of teachers is the average for all of the states, including the Territory of Hawaii, for the fiscal year 1929. While the ratio of state and local to federal money varies as between states, the figures for the year show that every state and the Territory of Hawaii spent more state and local money for approved purposes than was spent from federal funds. The ratio varies from \$7.57 for Massachusetts to slightly more than \$1 for a few of the smaller and less-populous states.

Experience indicates that a 100-per-cent utilization of available federal allotments is hardly to be expected. This situation is due to a variety of causes, such as budgetary control within the states and the enforcement of high standards for approval of schools for state and federal aid. During the fiscal year ended June 30, 1929, the states expended 96.7 per cent of the federal funds available, this being the highest percentage attained since 1917.

Enrollment figures for vocational schools and classes which have been organized and operated as a result of the impetus given to vocational education by the National Vocational Education Act are significant only when considered with regard to the varying conditions which prevail in the several states and the many different ways in which states utilize their federal allotments for vocational education. Enrollment figures for federally aided schools and classes constituted a fairly reliable index of progress during the first few years following 1917, but in 1926 it became apparent that those figures gave only a partial picture of the actual situation. Beginning in 1926, therefore, the federal board requested the states to supply additional enrollment figures for all vocational schools and classes promoted by the state boards for vocational education which conformed to the standards of the state plan, regardless of whether or not such schools and classes received federal aid from the state.

All the states and the Territory of Hawaii are free to apply federal funds for vocational education, allotted

under the National Vocational Education Act, in accordance with local needs, as determined by state boards for vocational education, provided the moneys are used for purposes which can be approved by the federal board. While one state may prorate its funds among all schools which meet the accepted standards, another state may, to a considerable extent, use the federal allotment for the support of new programs. A third state may finance its program of evening trade-extension classes entirely from state and local funds.

In states where such policies exist, a large volume of high-grade work may be in operation in addition to that indicated by statistical data on federally aided schools and classes. To omit enrollment figures for such schools would result in presenting a picture which would fall far short of portraying the growth and the present status of vocational education for the country as a whole. During the year, the enrollment in federally aided schools and classes of all types increased to 896,830, and for all schools reported by the states which meet the standards prescribed in the state plans the enrollment increased to 1,047,957. The year 1929, therefore, was the first year that the enrollment in vocational schools meeting prescribed standards has exceeded 1,000,000.

The enactment by Congress of the George-Reed Act and the extension of the vocational rehabilitation service to the District of Columbia by the Seventieth Congress can hardly be interpreted otherwise than as an indication of a favorable attitude on the part of Congress toward the work of vocational education and rehabilitation. The George-Reed Act was especially intended to assist in the development and extension of vocational education in agriculture and home economics in the states. While this act does not carry any increased appropriations for vocational trade and industrial education, it makes it possible for the states to release the 20 per cent of the trade and industrial education funds from the home-economics field and use that money for trade and industrial education.

The growth in trade and industrial schools and classes of all types for which provision is made under the federal act has continued at approximately the same rate as that which has prevailed since 1918, the total enrollment for the year in this field of federally aided vocational education being 563,496.

An analysis of the figures and a comparison of the different regions into which the country is divided for administrative purposes shows that the greatest increase is enrollment in trade and industrial work, not only numerically, but also in percentage, relative to 1928, is found in the Pacific region. The percentages of increase in 1929, as compared with 1928, are as follows:

	Per Cent
North Atlantic region, 13 States.....	0.64
Southern region, 12 States.....	3.76
Central region, 12 States.....	7.53
Pacific region, 11 States.....	17.48
Hawaii, Territory of.....	14.44

In view of all of the circumstances, it would appear that all of the men and women who are engaged in the important work of vocational education have a right to be optimistic concerning the future of the program. Vocational education is not only sound business educationally, but it is also 100-per-cent sound from the standpoint of the material well-being of the nation. It exists because of a fundamental economic and social need of the people, and in proportion as this need is met, with some degree of effectiveness, it will continue as an important factor in our educational system.



FRANK CUSHMAN
Chief, Industrial Education Service,
Federal Board for Vocational Education

Status of Vocational and Industrial-Arts Education in the Various States

TRADE AND INDUSTRIAL EDUCATION IN ARIZONA

George S. Sanders, State Supervisor of Trade and Industrial Education, Phoenix, Arizona

In Arizona, the state department of vocational education has no dealings with the high-school manual training. Each high school is a unit in itself and there is no uniform program for them to follow.



GEORGE S. SANDERS
State Supervisor of Trade and Industrial Education

During the past year the state Smith-Hughes vocational program has increased to a considerable extent. The number of classes has increased 300 per cent and the number of persons enrolled has increased over 200 per cent over last year's record.

Trade and industrial-education programs were carried on in eleven cities in the state, and during the past year 157 classes were organized with an enrollment of 2,130. These classes were conducted in the following subjects:

Shop mathematics
Blue-print reading
Elementary electricity
Trade English
Advanced electricity
Auto mechanics
Trade Spanish
Office training for employed office nurses
Blacksmithing
Sign painting
Electrical circuits and measurements
Sheet-metal drafting
Sewing
Leatherwork

Hand decorating
Mechanical drawing
Show-card writing
Nursing—42 different courses
Retail selling (part-time)
Printing
Architectural drawing
Machine shop
Welding
First Aid
Building estimating
Mineralogy
Foreman conferences
Plumbing
Cabinetwork.
Metallurgy

The part-time nurse-training program which is carried on in cooperation with the two hospitals in Phoenix is continuing to progress satisfactorily. The student nurses take their chemistry at the local high school, and their other instructional work at the hospital in which they are nursing. The salaries of these instructresses are paid by the high school and the hospital and 50 per cent reimbursement is received by them from the state department of vocational education.

A number of foreman conferences have been held during the past year. They have helped very materially in getting other classes organized. The conference work has been so successful that school mining districts have asked for persons to carry on the work for them upon a permanent basis.

It has been impossible to get qualified persons to do this, so a training program for prospective conference leaders will be necessary in the very near future. One of the mining companies defrayed the expenses of one of our conference leaders to go to Mexico to conduct a short program. This was quite successful.

In order to assure the efficiency and the success of the vocational work in the larger districts, the number of local supervisors has been gradually increased so that there are now six such supervisors in the state.

The state receives \$10,000 from federal funds for trade and industrial education and a total of \$68,000 annually from the state for all types of vocational education. This is really insufficient for our needs, but it was impossible to get more from the state legislature this year. It is well to note, that while the legislature cut almost every other appropriation asked for quite considerably, yet the same amount of money as last year was voted for vocational education without a question.

A total of \$20,056.82 was given schools as reimbursement for their expenditures during the year for trade and industrial education. This work could easily be doubled if funds were available. It may be necessary next year to reduce the proportion of reimbursement in order to develop a program which will more adequately fit the needs of the state.

VOCATIONAL EDUCATION IN ARKANSAS

E. B. Matthew, State Director of Vocational Education, Little Rock, Arkansas

The fiscal year ending July 1, 1929, shows a healthy growth in all divisions of the vocational work in Arkansas. The enrollment during the year in this type of work was 11,289, as against the previous year's enrollment of 9,374. This shows an expansion of 20.4 per cent.

The total expenditures for 1928-29 were \$264,918.81, while the expenditures for the previous year were \$250,201.38. From this it can be seen, that with an increased expenditure of 5.8 per cent there was a corresponding increase in the enrollment of 20.4 per cent.

In the trade and industrial field, several types of training new in this state have been organized, such as evening classes for radio operators, classes in refrigeration, welding, and a unit-trade class in cabinetwork. At the present time there are on file more requests for aid under apparently approvable conditions than can possibly be reimbursed from available state and federal funds. The problem from now on will be to select groups where the greatest number will receive the most effective training, rather than to search for groups where an approved class can be organized.

In home economics during the past year emphasis has been placed upon the improvement of the established work rather than upon the expansion of the program. The home-economics departments during the first ten years of the vocational program were operated largely at local expense. At present, however, the state and federal government bear one half the cost of the home-economics programs in these schools, and it is now possible to bring the schools up to a higher degree of efficiency. The passage of the George-Reed Act will have a wholesome, stimulating effect on this type of work, and should result in considerable expansion.

The growth of vocational education in agriculture has reached the stage in this state where it is having a very material effect upon the prosperity of our rural communities. Each teacher of vocational agriculture is gradually developing a community agricultural program based upon the economic needs of the entire patronage area which he

serves. While the results from these programs are best shown on a long-time basis rather than on an annual audit, the results of the past year were outstanding. The student returns from the practice program alone for all types of instruction, white and negro, the past year, totaled \$789,829.73, or an increase of 37.9 per cent over the preceding year. This is more than nine times the amount of the federal funds expended on the agricultural program.

The home-economics and trade and industrial divisions of the vocational program show equal efficiency. This would indicate that the expenditure for vocational education in Arkansas is a profitable investment.

TRADE AND INDUSTRIAL EDUCATION IN COLORADO

T. A. Tiemann, State Supervisor of Trade and Industrial Education, Fort Collins, Colorado

During the fiscal year ending June 30, 1929, a total of 9,663 individuals received the benefits of trade and industrial education in evening, part-time, and day trade classes in this state. This represents an increase in enrollment of 1,627 over last year.

Evening-school programs were established at Colorado Springs, Fort Collins, and Grand Junction. The Colorado Springs program offered courses primarily for men employed in the motion-picture and aircraft industries, by the Alexander Industries Incorporated. A more diversified program was established in Fort Collins, being of service to the auto-repair, painting, and auto-service trades. The Grand Junction program was established to serve the locomotive fireman and engineers, employed by the Denver & Rio Grande Western Railway.

One new trade-preparatory part-time class was established in Fort Collins for the purpose of teaching the Indian blanket weaving trade to Mexicans employed in the beet fields of this district. The industrial committee of the Fort Collins Chamber of Commerce cooperated with the state board in establishing this school. Materials and supplies sufficient for the establishment of the school were furnished by the Fort Collins Chamber of Commerce. Students attended when not employed in the beet fields, and 22 such part-time students were enrolled from September 11 to June 1. The average daily attendance was six. Four of the students, through this training, became proficient enough to be able to weave for the commercial market. The result of this experiment seems to indicate that the school will serve a useful purpose in the Mexican communities of northern Colorado.

The day trade school at Sterling, Colo., was discontinued, while one class, in the Denver Opportunity School was established on a trade basis. Another day trade school in aeronautics was established in Pueblo. The Alexander Aircraft Corporation, Colorado Springs, donated considerable equipment to the school, and also agreed to give preferential employment to graduates of the course.

A total of 135 evening classes were successfully carried on during the year. Much of the evening-school work is on the individual-instruction basis with students coming and going throughout the day and evening. The locomotive-engineering and mining instruction is largely of this "in-and-out" character. Such work does not lend itself to classification by classes. If we assume an average of 15 students to the class, and divide the total enrollment in mining and locomotive-engineering subjects by 15, the total number of evening classes for the year would equal 191. A better way to emphasize the growth of evening-school work in industrial education in Colorado, is to call attention to the fact that in 1928 there were 3,905 students enrolled in evening classes, who were taught by 156 teachers, while in 1928 there were 5,329 students, and 135 teachers.

In the part-time field, 67 trade-preparatory and trade-extension-classes were carried on, serving 17 different trades. Of this number 15 were apprentice-training classes serving 8 different trades. In 1928, 3,688 students were enrolled in part-time trade classes under 68 different teachers. In 1929, 3,829 students were enrolled and 64 teachers were employed to instruct the classes.

The general continuation classes continued to increase, although due to a change in policy regarding reimbursement to the local school districts for such work, fewer classes were reported to the State Board for Vocational Education than were reported in 1928. In 1928, 14 teachers carried on classwork with a total enrollment of 364 students; whereas in 1929, 492 students were enrolled under three different teachers.

The number of day trade schools has increased from 5 to 6. One school was discontinued, and another was established in its place. In reality, therefore, two new day trade schools were established. Eighty-one students were enrolled under five different teachers in day trade classes in 1928. In 1929, 77 students were enrolled in six different classes.

State Supervision

The state supervisor of industrial education devotes one third of his time to the supervision of trade and industrial education, one third to teacher training in the field of industrial education, and one third to supervision of civilian rehabilitation work.

The state supervisor centered his efforts in the improvement of teachers in service, and in constructive inspection and supervision of classes with a view toward improving the quality of the teaching. Very little promotional work was done this year primarily because of the large amount of time that was consumed in promoting rehabilitation legislation.

Conferences Held

Three important conferences were held during the year, two of them in connection with the 1928 summer session of the Colorado Agricultural College, the other in the city of Denver. One of the summer-session conferences dealt with locomotive-engineering instructors employed in the states of Nebraska, Kansas, Wyoming, Idaho, and Colorado. This group of men set up a plan for training locomotive firemen and engineers in the more efficient performance of their duties.

The other conference dealt with an analysis of the training opportunities in the oil-production industries; representatives of Colorado, Oklahoma, and Wyoming participating in the conference.

The Denver conference dealt with the question of professional improvement of teachers in service, and 37 teachers of the opportunity school and evening vocational high school attended. The conference with Denver teachers resulted in establishing three teacher-training classes in that center.

Teacher Training

Four types of teacher-training courses are offered: Short-unit, intensive, summer-session conferences; extension courses; courses under the direct supervision of local directors in Districts Nos. 1 and 20 of Pueblo, and District No. 61 of Trinidad; and itinerant teacher training carried on by the state supervisor of industrial education incidental to his work in supervision.

The entire facilities of the Colorado Agricultural College are available for intensive training courses and extension courses operated under the direction of the institution. For such work as is done under local supervision, the facilities of the local school district are available for teacher-training work.

Supervised observation and practice teaching is carried on under actual teaching conditions. There is no formal preemployment program of observation and practice teaching. Soon after the new trade teacher is employed, he is given full responsibility for carrying the teaching load with the understanding that the state supervisor or the local director will give him such help and assistance as may be necessary to enable him to successfully perform the duties of his job. At the end of the first year of such teaching he is required to take several short-unit courses during the summer session. This plan has proved to be very effective in the state of Colorado.

Where new men without teacher-training experience are placed in employment, the state supervisor arranges fre-

quent supervisory visits on which occasions teacher-training work is carried on in an informal way. In general, such teacher training takes the form of problem discussions on difficulties which the new teacher is experiencing. This year six new men were so trained, and all of them did successful work during their first year of teaching.

A minimum of five years of trade experience is required of all trade and industrial teachers. Men selected from the trades are sometimes required to take preemployment training. In general, however, they may be employed without such training under a temporary approval plan which gives the local community the greatest possible leeway in selecting men of exceptional trade ability. Under a special plan, the Colorado State Board of Agriculture admits a certain number of highly selected men to the summer-session courses of the Colorado Agricultural College to work for the bachelor of science degree in industrial education. Such men are selected by a committee. This committee prescribes the course of study, and particular case procedure on the basis of an analysis of the accomplishment of the individual, his needs, desires, and future opportunities. The Colorado Agricultural College has permitted such "prescription" courses to take precedence over the formal curriculum, and all conflicting regulations are waived in favor of this highly selected group of trade teachers and supervisors.

Schools Meeting the Standard of the State Plan

A number of classes are carried on in industry or in commercial establishments, that meet the standard of the state plan for vocational education. They are operating as corporation schools, and are serving the employees of such corporations in practically the same way that employees of other organizations are being served through the program of the state board of vocational education.

Conclusions

In general, the Colorado industrial-education program is in a healthy condition at the present time. The quality of the instruction is high, and this is largely due to our teacher-training program which has produced teachers who are earnestly striving to improve their teaching and their programs in general. Considerable new work is being planned for next year including an extension of our foremanship-training activities to the oil-refining and railroad industries; the organization of part-time apprentice classes in the C. B. & A. R. R. shops; the establishment of new evening trade-extension classes in mining, railroad, and smelting industries, and additional help in state and local supervision.

INDUSTRIAL EDUCATION

**J. E. Fuels, Assistant Supervisor of Industrial Education,
Springfield, Illinois**

The staff in industrial education for the year 1928-29 consisted of a supervisor, one assistant supervisor, and an assistant in teacher training, each serving on a full-time basis.

Twenty-three cities conducted trade and industrial classes during the year, enrolling a total of 26,349 pupils.

Evening trade-extension classes were conducted in 16 different cities with a total enrollment of 4,883 pupils and 169 teachers.

Part-time trade-extension classes for apprentices were conducted in seven cities with a total enrollment of 3,552 pupils under 46 teachers.

Full-time classes were conducted in fourteen cities with a total enrollment of 1,446 pupils and 95 teachers.

Part-time general continuation schools were in operation in eight cities with a total enrollment of 16,468 pupils, under 132 teachers.

The University of Illinois, under the supervision of the state board for vocational education, conducted teacher-training courses in eight cities with a total enrollment in all teacher-training classes of 795 with two instructors in charge.

The following types of instruction were offered in secondary industrial schools during the year 1928-29:

Part-time Schools (For persons at work who attend part-

time schools four to eight hours a week during working hours).

1. Trade-extension courses: Instruction was given in the shopwork, the trade drawing, the trade science, and the trade mathematics, which are related to the following trades; baking, carpentry, electrical work, machine-shop practice, painting and paper hanging, plumbing, railroad repairwork, sheet-metal work, and steam fitting.

2. Commercial courses: Instruction was given in citizenship, English and hygiene; and in accounting, office practice, retail selling, stenography, and commercial arithmetic.

3. General education courses: Instruction was given in citizenship, elementary science, English, geography, history, hygiene, mathematics, and home economics including cooking, sewing, millinery and homecraft; and in manual training in sheet metal, auto repair, cabinetmaking, carpentry, electrical work, forging, general woodwork, home mechanics, machine-shop practice, mechanical drawing, pattern-making, plumbing, and printing.

Evening Schools (For persons at work who attend evening schools two to eight hours a week outside of working hours).

Instruction was given in architectural drafting, auto repair, baking, blue-print reading and estimating, carpentry, coal mining, electrical construction, engineering mechanics, foremanship, forging, hoisting engineering, ignition, industrial chemistry, linotype, machine-shop practice, monotype, oxyacetylene welding, press feeding, printing, sheet-metal work, strength of materials, tailoring, trade drawing and trade mathematics.

Full-time or All-Day Trade Schools (For persons devoting their full-time to school attendance, 30 clock hours a week for 40 weeks a year).

Trade courses were conducted for the following trades: Architectural drafting, auto repair, cabinetwork, carpentry, electrical, machine shop, mechanical drafting, patternmaking, plumbing, printing, and sheet metal. In each case, related trade subjects were offered.

The following table shows information taken for the year ending June 30, 1929, for cities conducting industrial schools and classes under the supervision of the state board for vocational education.

ALL TYPES OF SCHOOLS COMBINED

City	No. of Pupils	No. of Teachers	Reimbursement
Aurora, East	147	9	\$ 2,552.00
Aurora, West	53	9	3,274.34
Belleville	84	4	494.44
Bridgeport	14	3	545.00
Champaign	200	13	1,991.25
Chicago	21,328	197	204,699.56
Chicago Heights	30	2	170.00
Cicero	1,180	37	25,944.50
DuQuoin	11	1	80.00
Granite City	253	21	11,110.25
Harvey	204	14	6,118.50
Highland Park	195	8	3,152.75
Joliet	1,042	49	36,739.26
Moline	96	1	1,800.00
Pana	25	3	842.70
Peoria	215	14	4,981.37
Quincy	59	2	200.00
Rockford	693	25	9,756.75
Rock Island	8	3	1,191.25
Spring Valley	57	5	3,550.41
Sterling	32	2	240.00
Urbana	170	9	245.00
Waukegan	253	11	5,379.37
Total	26,349	442	\$325,058.70

INDUSTRIAL EDUCATION IN INDIANA

**George K. Wells, State Supervisor of Industrial Education,
Indianapolis, Indiana
Vocational-Industrial**

In Indiana the program of part-time education is developing in a healthy way. There are now four cities offering classes on the cooperative plan, and four cities doing part-time work with apprentices. The bulk of the apprentice training is still being done on the evening-school basis.

The part-time trade-extension schools are constantly enrolling more pupils, while the evening-school enrollment also continues to increase. There were more pupils in evening-school trade-extension work last year, than for any year in the past five. A total reimbursement of \$118,-

037.48 was paid for industrial training of all types in the state. This was on the basis of one third of the salary of the teachers and supervisors.

Several experiments and studies are planned for the coming year which will, we hope, throw more light on the best methods of doing vocational-industrial work. These experiments are being directed by the state supervisor with the cooperation of the state university and a committee of five men from the State Directors Association.

Industrial Arts

The industrial-arts work in the state has continued to grow during the past year. More emphasis is constantly being laid on the general-shop plan and more schools are introducing it into the grade- and junior-high-school work.

Committees have been at work during the past year on the revision of the state course of study. This is to be distributed in September. All courses have been revised and a very complete outline of each type of work has been made. In order to promote its adoption a record sheet is being prepared by the state department to be used in the classes. One page of this sheet provides a place for the teacher to list the things he expects the boy to be able to do, and the other a list of things he expects the boy to know. A system of recording is provided and the sheet is to be returned to the state office at the end of the course. Standard tests are to be provided for those teachers who will use them at the end of the course. A study will then be made of the results of using the state course.

TRADE AND INDUSTRIAL EDUCATION IN IOWA

H. W. Carmichael, Supervisor, Trade and Industrial Education, Board of Vocational Education, Des Moines, Iowa

The trade and industrial-education program for Iowa during the past year experienced a few important changes, due to the fact that Iowa, which has always been an essentially agricultural state, is now more than ever depending upon the school for the training of workers to fill the positions offered by diversified industry in its numerous small cities.

The industrial situation during the past year has made rapid strides toward normal conditions. There has been some restriction in the building-trades field in some parts of the state but in most of the larger cities building is about normal. Mining operation is still very slow and due to this condition no evening classes for miners were organized in the state during the past school year. If this industry shows any signs of coming back this winter, an attempt will be made to offer some evening-school work related to the miner's occupation.

Opportunity was offered to interested men and women employed in the Iowa industries for self-improvement in their chosen fields of work through evening extension classes that were conducted by practical teachers in shops, industrial plants, and school buildings in 25 different cities of the state. Cities offering evening extension classes were as follows:

Ames, Atlantic, Burlington, Cedar Rapids, Charles City, Clinton, Clarinda, Davenport, Des Moines, Dubuque, Fort Dodge, Fort Madison, Keokuk, Marshalltown, Newton, Shenandoah, Sioux City, and Waterloo.

The classes in this program enrolled 1,236 men, and 273 women. This is a considerable falling off in attendance in comparison with last year's enrollment figures, especially among the women, which was due mostly to the fact that no women's classes which bordering on the homemaking status, were reimbursed.

The general attendance all over the state, however, was affected by an epidemic of flu and a terrific spell of severe winter weather which covered the streets with a coating of ice that hampered transportation facilities for six weeks.

New evening classes were organized in Ames, Clarinda, Clinton, Cedar Rapids, Dubuque, Fort Dodge, Keokuk, Shenandoah, and Sioux City.

New Classes for nurses were organized in Burlington,

Cherokee, Clinton, Estherville, Hampton, Muscatine, Oska-loosa, and Ottumwa.

Part-time trade-extension classes were conducted in the following eight cities: Burlington, Cedar Rapids, Council Bluffs, Davenport, Des Moines, Dubuque, Marshalltown, and Newton. These classes were conducted in cooperation with employers who send their apprentices and other learners to school on a part-time basis for a minimum of 144 hours during the school year. The time for instruction is taken out of the actual working day and regular pay is allowed. The instruction is directly related to the daily occupations and is usually given in classrooms at the plant. Thirteen classes were in operation during the past year, with an enrollment of 235 men and 253 women.

Next September a new part-time apprenticeship program will be started in Dubuque in cooperation with the Dubuque Manufacturers' Association. Two classes will be organized and the part-time cooperative plan will be effective.

All day trade and industrial classes were conducted in the following nine cities: Ames, Burlington, Charles City, Lyons District (Clinton), Dubuque, Fort Dodge, Fort Madison, LeMars, and Sioux City. These cities have some excellent opportunities for the placement of school-trained workers of high-school age.

Unit trade courses are conducted as a part of the high-school curriculum in the larger cities, while the general industrial course fits the need of the smaller cities by centering around a typical industry but is not limited to a single trade.

These courses are two years in length and offer a minimum of half-time trade training. The enrollment during the past year included 657 boys. This increase in enrollment over last year's figure of 347 boys is due to the organization of new general industrial and unit trade classes at Charles City, Fort Dodge, Fort Madison, LeMars, and Sioux City.

The city of Newton conducted classes during the past school year in the part-time cooperative trade and industrial program with an enrollment of 34 boys. Sioux City conducted two classes in the part-time cooperative retail selling and store work with an enrollment of 32 girls and 8 boys.

The general continuation schools were conducted in the following 11 cities: Burlington, Cedar Rapids, Davenport, Des Moines, Dubuque, Fort Madison, Keokuk, Marshalltown, Muscatine, Ottumwa, and Sioux City. These schools will continue to occupy an important place in the public-school organizations of Iowa as long as juvenile employment is permissible by law. However, many of the continuation-school pupils are returning to the regular classes in the full-time schools.

The gradual decrease in continuation-school enrollment in Iowa is an indication that the public schools are holding more of their pupils between the ages of 14 and 16 years in regular full-time classes. It is also a fact that young workers of the continuation-school age are no longer able to compete with high-school graduates for the jobs that were formerly open to them, and also that employers do not like to hire juvenile workers who are under the jurisdiction of the child-labor law.

The continuation-school enrollment for the past school year was 374 boys and 467 girls.

The engineering extension department of the Iowa State College at Ames, in cooperation with the state board for vocational education, maintains two itinerant instructors in foremanship and teacher training. This service reached 30 industrial plants and 8 teacher-training centers throughout the state, and these classes enrolled a total of 751 men and 31 women in both teacher-training and foremanship classes.

Important Developments of the Year

The outstanding developments in the trade and industrial-educational field have been the new classes organized in the all-day schools and the interest that is being shown in the part-time cooperative program of vocational training. This interest is the fruit of promotional work that has been done during the past year by the state supervisor of trades and industries, and the local directors in several of our larger cities. The future possibilities of this promo-

tional work, however, will depend largely upon continued improvement in business and financial conditions which will make additional employment opportunities for new workers.

Undeveloped Fields and Areas

The undeveloped fields are mostly in the clay products, gypsum and cement industries, sugar, meat, and other food industries. The highly specialized type of job and the type of worker employed in these particular industries do not tend to raise the occupations into the class of the skilled worker. Therefore very little can be offered in the way of vocational training that will supplement their day employment. Most of these workers are of the foreign-born element and are primarily interested in the Americanization type of evening school education.

Four cities, Fairfield, Charles City, Keokuk, and West Waterloo, are excellent prospects for additional vocational classes in the metal-working industries, especially along the lines of cooperative training. The printing industry at Cedar Rapids, Davenport, Des Moines, and Sioux City, will be splendid prospects for the training of printing apprentices when the local unions in these cities can agree on a logical program. However, better working conditions will have to become a reality in the cities mentioned in the foregoing before any real vocational-educational developments can take place.

PROGRESS OF VOCATIONAL AND INDUSTRIAL EDUCATION IN KANSAS

C. M. Miller, Director of Trade and Industries,
Topeka, Kansas

Vocational education has had a gradual but very substantial growth in Kansas during the past few years. Nothing spectacular has been accomplished, but satisfactory progress has been made. For the year ending June 30, 1929, Kansas had one hundred high schools offering vocational agriculture on the vocational half-day basis. The



C. M. MILLER
Director Trade and Industries,
Topeka, Kansas

enrollment in these schools was 2,024. In addition to the day schools, evening classes were operated in thirteen communities for adult farmers, with a total enrollment of 552. Of course, the number of boys actually enrolled in agriculture classes and the number of adult farmers actually enrolled in evening classes together do not nearly represent the number of people reached through vocational-agriculture courses, for practically every home represented is influenced to a greater or less degree by vocational-agriculture instruction. Furthermore, the agricultural practice in many homes not represented by enrollment in the classes is improved by attendance upon community meetings and various contacts with the teacher of vocational agriculture and his pupils.

Industrial Arts

Some form of industrial arts is offered in 481 Kansas high schools. The tendency in industrial arts is to vary the

program rather than to confine it to the woodworking projects as was originally true. In all the larger high schools and many of the more progressive smaller high schools, instruction is offered in woodworking, electricity, sheet metal, automobile and gas engines, concrete work, and in some cases elementary plumbing, and acetylene and electric welding. Mechanical drawing is usually required of all students taking any other industrial-arts subjects.

Also in all the larger and many of the small high schools, industrial-arts subjects are offered in the junior high school or in the first years of the senior high school. The tendency is toward offering industrial-arts work in the earlier years of the school course.

There is also a very marked tendency toward requiring higher standards for teachers in order that their work may be made to approach more nearly the vocational ideal. It is felt that approaching the vocational ideal does not detract from the general educational value of industrial-arts subjects; in other words, it is worse than useless to teach skills in the name of industrial arts which have to be unlearned if a boy enters a trade in which the same skills are involved.

Vocational Trade Classes

Vocational day trade classes have had a slow and somewhat discouraging growth in Kansas due largely to two things.

First: We have not got away from the idea of attempting to prepare everybody that goes to high school for college, and the first thing that "bobs up" when we talk vocational day trade classes is how much high school credit will be given. We are still thinking in terms of school credit rather than in terms of trade preparation. We attempt to supplement an academic education with some trade training rather than making the trade training the major objective supplementing it with such academic training as can be given.

Second: Lack of trade density has made it particularly difficult to maintain day trade classes. There are not enough boys in any given community who are interested in a trade to maintain a class.

During the year ending June 30, 1929, we conducted fourteen day trade classes with a total enrollment of 233.

Evening vocational trade classes were conducted in 23 communities in which instruction was offered in 27 different trade subjects. The total enrollment in evening trade classes was 3,563.

Looking Ahead

Prospects for vocational education were never brighter than at the present time. There are more people in Kansas occupying positions of influence who know about the progress of vocational education than there has ever been. There are very, very few who know about it and oppose it. It is a going concern and gradually gathering momentum and power as it goes.

PROGRESS IN MAINE

S. E. Patrick, Director of Vocational Education,
Augusta, Maine

The legislature increased its grant for vocational education by 50 per cent at the last session. Five new vocational departments have been established during the past year, one in agriculture at Limington Academy; three in home economics at Freeport, Scarborough, and Bath; and one in trades and industry at Rumford. This latter is cooperative between the town of Rumford and the Continental Paper and Bag Mills. The instructor, Mr. McManus, has had an extensive experience in the paper-mill industry and is principal of the local evening school. His time is devoted to the training of new workers, the upgrading of workmen, and the conducting of foremen conferences.

In the industrial-education field, we have added three new schools in home economics and three in manual arts.

In vocational agriculture we have 24 schools; in vocational home economics, 4 schools; in trade and industry, 4 schools; in manual arts, 53 schools; and in home economics, 80 schools.

VOCATIONAL EDUCATION IN MASSACHUSETTS

**R. O. Small, Director of Vocational Education,
Boston, Massachusetts**

Progress in vocational education in Massachusetts during the past year may be summarized as follows:

Legislature

A bill increasing the hours of attendance and otherwise expanding the work of the continuation school was referred by the 1929 Legislature to a recess committee for further study.



R. O. SMALL
Director Vocational Education,
Boston, Mass.

The Legislature established the Massachusetts Industrial Commission, within the Department of Labor and Industries, to "promote the industrial, agricultural, and recreational interests of the Commonwealth."

Field of Agriculture

A new agricultural department is to be opened at Agawam in September.

The agricultural department at Hanover, started a year ago with a half-time instructor, will employ a full-time teacher this year. It will also add a farm automotive unit to its course.

Other schools and departments planning to offer winter-term automotive units are those at Norfolk County Agricultural School (both the center at Walpole and the branch at Weymouth), New Salem, Westport, and Agawam.

Field of Industry

Gloucester organized and successfully conducted a day industrial school giving training in power-machine operating, with a six weeks' unit course, leading to immediate employment in local factories.

Boston opened two new cooperative high schools with trade unit courses: South Boston, sheet metal, and Roxbury Memorial, printing. Supplementing these and the other five cooperative high schools are: Brighton, automobile; Charlestown, electricity; Dorchester, cabinetmaking; East Boston, machine; and Hyde Park, machine. All-day industrial-school organizations have been perfected and approved, to care more adequately for fluctuation in employment.

The Boston Trade School and the Beverly Industrial school each added a carpentry department.

The Waltham Trade School is doubling the size of each of its four departments in September.

The New Bedford Vocational School moved most of its departments into its new buildings, where the school will be more adequately housed than ever before.

The Hyde Park Cooperative High School (Boston) moved into a new building.

The Boston Continuation School has added departments of household mechanics and bookbinding.

New courses offered in evening industrial schools are: Beverly, printing; Boston, plastering; Southbridge, pattern-making; Springfield, plumbing; Waltham, carpentry and automobile repair; Worcester, sheet metal.

Field of Household Arts

New household-arts departments have been established in the high schools of Bourne, Holyoke, and Shelburne Falls. The departments at Belchertown and Hatfield are being reorganized on a two-year basis. Work in the social and economic aspects of homemaking, and family and community relationships, is being emphasized in the household-arts programs of the state.

Evening practical-art work has been recently established at Rockport and Somerville. It has been extended in other cities by additional units as follows: foods at Beverly, Leominster, Natick, and Newton; home nursing at Cambridge, Everett, and Norwood; decoration at Lynn, North Attleboro, Quincy, and Webster.

The expenditures of the state in the form of reimbursement to local communities during 1928-29 were estimated at \$1,470,027.28. A total of 182 schools now offer vocational part-time or full-time classes. The work is carried on in 75 cities, and the enrollment amounts to 53,989. The Smith-Hughes allotment for the state was \$251,671.94. The cost per student hour was 18.1 cents in 1927-28.

INDUSTRIAL EDUCATION IN MICHIGAN

**K. G. Smith, State Supervisor of Industrial Education,
Lansing, Michigan**

Interest in apprenticeship which started some three years ago, has grown slowly, though the automobile industry is so highly specialized that apprenticeship does not flourish in connection with it. The following numbers were enrolled as apprentices in the cities mentioned: Detroit, 759; Jackson, 24; Pontiac, 58; and Bay City, 37.

These boys were all in school four hours a week on a trade-extension basis.

Part-Time Schools

The total enrollment in trade-extension and trade-preparatory classes in our part-time schools was 4,236 boys and 178 girls; in general continuation classes 4,192 boys and 6,652 girls. Teachers and coordinators placed in employment 2,917 boys and 2,652 girls. The total amount spent for part-time instruction was \$234,061.76, of which \$89,499.96 was state and federal funds. Seventy-five per cent of these boys and girls were employed and earned approximately \$12 per week for twenty weeks a year. On this basis their earnings amount to \$2,400,000 per year or more than ten times the amount spent on their education.

All-Day Trade Schools

All-day trade schools did excellent work in thirteen trades. In ten cities and eighteen schools, 1,528 boys and 165 girls were enrolled. The total amount spent was \$106,751.27, representing an expenditure of \$63 per pupil for trade instruction. Students of trade courses, rarely remain more than two years in school. They leave to enter employment and become producers. The amount spent for their education is small compared with that spent for the education of four-year-high-school and college students.

Evening Schools

Evening-school enrollment was larger than last year, the total enrollment being 10,548 men and 37 women. The total amount spent for trade-extension evening classes was \$54,239.33. The average percentage of attendance in eleven cities was 75. Saginaw stood at the head with a percentage of attendance of 90.5.

General

Detroit is building a Boys' Vocational School which will be operated on an all-day trade, part-time cooperative, and evening basis.

Grand Rapids is building a \$568,000 addition to the Vocational and Technical High School. This school had an increase of 38 per cent in attendance this fall.

Pontiac has just completed a very fine industrial-arts building, housing all industrial-arts activities for the senior high and part-time school.

Private Trade Schools

In spite of all that public schools can do, there still remains a large field for the private trade school for adults.

The enrollment in these schools indicates how insistent is the demand for education for earning a living.

ENROLLMENT IN PRIVATE SCHOOLS

	Men	Women
Industrial occupations (24 trades).....	4,579	66
Henry Ford Trade School.....	6,174	...
Barber schools.....	501	4
Commercial-art schools.....	568	256
Motion-picture operation.....	52	...
Dressmaking.....	3	325
Mechanical dentistry.....	169	6
Beauty culture.....	7	2,202
Total.....	12,053	2,859

These private trade schools, with the exception of the Henry Ford Trade School, are distinctly schools for adults.

PROGRESS IN MINNESOTA

Dean M. Schweickhard, State Supervisor of Trade and Industrial Education, St. Paul, Minnesota

In Minnesota, as in most states, industrial arts in general education is quite distinct from industrial education of a vocational character. In the general-education field during the past year, Minnesota paid to the schools of the state, aid amounting to \$82,376. The work was carried on by 120 instructors in 204 schools located in 166 different cities



DEAN SCHWEICKHARD

State Supervisor, Trade and Industrial Education, St. Paul, Minn.

and towns. The total expenditure for salaries was approximately \$750,000, and that for maintenance of departments, aside from overhead, \$100,000. As a general rule, the work is not offered below the seventh grade but continues from that upward through the high school. During 1929 there were 18,240 boys enrolled in industrial work from the seventh and eighth grades and 16,806 from the high schools, making a total of 35,046. Considering the cost of salaries and the cost of maintenance as the total cost incidental to conducting this type of work, the per-capita cost amounts to a little over \$24 per year. These figures may or may not be significant except by comparison, but comparison of costs might mean one thing to one reader and something different to another. The gradual addition of departments, however, probably indicates increasing popularity in favor of this phase of schoolwork among school people. During the past seven-year period there has been an increase of slightly over 50 departments in the schools of the state, making an average of somewhat over seven departments per year. The average increase apparently is still being maintained, for during 1929 seven new departments opened which were not in operation previously. For 1930, eight schools have applied for recognition of a standard industrial department.

The standard arrangement of work in a Minnesota department embraces general mechanics, mechanical drawing, woodwork, and electricity. These subjects are required as a minimum on the assumption that any school shop formerly planned and equipped for woodwork and drawing only, can easily be arranged also, to handle general mechanics and electricity. In schools with greater facilities, a course in general metal work is added and schools

wishing to round out the program still more, offer printing. These six fundamental lines of work are considered as constituting a complete junior-high-school course in general industrial education and are offered in about the order here indicated. Industrial-arts work in the senior high school is made up of various advanced courses in drawing and special courses in shopwork where equipment is available.

The opening of the present school year has shown a slight shortage in teachers of industrial arts. This may be explained partially by the fact of a new certification law becoming effective in Minnesota. Under this law industrial-arts teachers coming into the field are required to have a college degree with a minimum of 45 quarter credits in industrial-arts subjects. It is believed that this requirement will raise the general standard of industrial-arts teaching, and also assist greatly in situations where the industrial-arts teacher is required to teach one or more academic high-school subjects. Present indications are that the tendency is for slightly increased salaries. Industrial-arts teachers possessing the proper qualifications will have little difficulty in securing employment in Minnesota during the coming year.

Trade and industrial education of a vocational nature has been conducted to a large extent in the three large cities of the state. For this purpose, all of the funds available have been expended and have been matched by about three times as much in state funds. The number of teachers employed in this field is 98, with an approximate total salary of \$200,000. The initial cost of equipment for this type of work is considerably higher than for industrial arts, but the operating expense is somewhat lower due to larger classes and less-expensive buildings. The teacher turnover in the vocational field is considerably less than in the industrial-arts field. In fact, it has become practically stable. During the past year or two, the tendency for this work to spread into the small communities of the state has been quite marked. Several of the moderate-size communities have attempted part-time work in store and office training which is a subsidiary of trade and industrial education, and in the smaller communities a half dozen attempts have been made in the organization and conduct of building-trade courses on the general industrial basis.

Out of the whole situation it appears that the school people of Minnesota are coming to see clearly the place of industrial arts in a well-rounded education, the nature and purpose of vocational training in the trades and industries, and the distinction between these two valuable forms of industrial education.

INDUSTRIAL EDUCATION IN MISSOURI

C. L. Wetzel, State Supervisor of Trade and Industrial Education, Jefferson, Missouri

During the school year 1928-29, attention was centered especially on the promotion of apprentice classes and part-time classes.

Due to the active enforcement of the state school laws and the child labor laws, only five cities in the state held continuation classes, since the law requires the organization of such classes only when there are at least 25 children between the ages of 14 and 16 holding work permits. In one of these five cities, however, the continuation classes were organized during this year.

Some new part-time cooperative classes were formed and a number of day trade-school classes were expanded to include cooperative education. In one center, certain employees of an electric lighting company attended a part-time trade-extension class organized to give instruction relative to home electrical appliances. A number of classes were conducted for colored maids in service.

Evening trade-extension classes were organized in seven centers offering adult education to approximately 3,000 men and women, representing 23 trades, exclusive of the trades represented in the railroad shop classes in two centers. The number of centers organizing classes for regularly indentured apprentices showed a remarkable increase over preceding years. In one city more than 900 apprentices in the building trades and in printing met four hours per

week, studying the related technical contents of their trade. Carpenters, electricians, plasterers, lathers, painters, plumbers, and sheet-metal workers were represented from the building trades. One new center organized and conducted a very successful class for locomotive shop employees. The enrollment increased in the classes where steamfitters were being taught pipe welding. Considerable promotion of new classes in smaller cities was undertaken, with the



C. L. WETZEL
State Supervisor Trade and Industrial
Education, Jefferson, Mo.

result that several new centers are offering trade-extension evening classes early in the fall of 1929.

A special agent of the state board for vocational education conducted foreman conferences for a large number of industrial plants within the state. An intensive conference was held in St. Louis for the purpose of training a small group of selected men to become conference leaders. At the same time certain assistance was rendered a large utility company in setting up an educational department within that particular property.

The unit day trade-preparatory schools reorganized their related-subject courses and materially increased the teaching efficiency. Four vocational building-trades classes in the smaller cities, constructed five complete houses during the school year. Other production work was carried on as a device for teaching the trades. Many trade classes entered exhibits in the state fair illustrating the types of production jobs that are used for training future craftsmen. A new class in auto mechanics was organized for the forthcoming year in one of the industrial districts of the state.

In the spring of 1929, the second annual trade and industrial teachers' conference was held in Jefferson City. Although attendance was voluntary and entirely at the expense of the teachers, approximately two thirds of all the trade teachers in the state were present and participated in the various round-table discussions. Each apprentice class was represented by a member of the educational committee from the particular organization sponsoring that class. The trade and industrial teachers of the state participated as a unit in the annual meeting of the Missouri Vocational Association in the fall of 1928. In addition to this meeting, each fall the trade teachers and the industrial-arts teachers unite in a department meeting during one afternoon of the state teachers' association meetings.

Teacher training has acquired a new interest in the state. An unusually large number of the trade teachers attended summer school at Smith-Hughes teacher-training institutions. In addition, two members of the teacher-training staff carried their courses directly to teachers in service during the winter, in three of the larger cities. Plans have been made to extend this opportunity to four additional cities during the year 1929-30.

In the field of industrial-arts education, several cities organized new courses in manual training, both in the small high school and in the junior high school. Groups

of manual-training teachers met in district conferences, and discussed the trend in their field. According to a number of reports, these meetings were profitable and enthusiastic. The summer sessions of the state teachers colleges were well attended by manual-training teachers.

GROWTH OF THE TRADE AND INDUSTRIAL PROGRAM

Harvey L. Freeland, Supervisor of Trade and Industrial Education, Lincoln, Nebraska

During the year just closed there was a total enrollment of 4,077 in reimbursable trade and industrial classes. This is an increase of 175 per cent over the enrollment of 1925. This growth is due in part to good preliminary work which had been done in the state prior to 1926, to splendid co-operation on the part of school superintendents and boards of education, and to a gradual awakening on the part of the industrial group in the state to a knowledge of the service which the public schools can render in the way of industrial education.

A movie film showing the work of industrial education classes during the past year would be interesting. It would show boys in day trade classes at Falls City, Hastings, and Lincoln, being prepared for advanced trade en-



HARVEY L. FREELAND
Supervisor Trade and Industrial
Education, Lincoln, Nebr.

trance in carpentry, auto mechanics, auto electricity, industrial electricity, and printing. A parade of the automobiles which passed through the auto-mechanics shop at the Lincoln High School would reveal a total of 515 cars of 22 makes ranging from Fords to Lincolns—a range and quantity sufficiently large to provide effective training. We would see the apprentices of the Union Pacific and Burlington Railroads at Omaha, Havelock, Grand Island, and North Platte being sent to school for four hours per week to receive instruction in blue-print reading, trade mathematics drawing, machine-shop practice, car building, adjustment of shoes and wedges, oxyacetylene and electric welding, valve setting, A.R.A. rules, and airbrake-work.

Flashes from the evening-school program would reveal more than 3,100 men and women, who have already assumed responsibility, and started upon life's work, ranging in age from 20 to 60 years, and enrolled in 132 different classes, taking work supplemental to their daily employment. Among these would be auto mechanics, bakers, bricklayers, carpenters, car builders, electricians, janitors, machinists, nurses, painters, plumbers, railroad firemen and engineers, sugar-factory employees, and telephone repairmen.

In real life it is difficult to predict the future, but it seems that the service which the public schools of the state are now rendering to men and women in the trades and industries, is a promise of the future growth of this type of educational work.

MANUAL TRAINING IN NEW JERSEY

Robert A. Campbell, State Supervisor of Industrial Education, Trenton, New Jersey

There are 206 districts in the State of New Jersey offering manual arts in the public schools. This enables 330,330 pupils to receive instruction in manual arts and home economics. In order to maintain these courses the State of New Jersey is spending \$2,278,389.47. Covering a period of five years, over 2,000 new school buildings have been erected in the State of New Jersey.



ROBERT A. CAMPBELL
Supervisor Industrial Education,
Trenton, N. J.

The erection of so many new school buildings in this state has necessitated a very careful study of the industrial-arts work. The state board of education established a ruling that the proper representative of school districts and the department of public instruction shall decide upon the policy to be adopted for establishing new departments for industrial arts and home economics. Such a measure has made it possible to have a conference with school architects, members of local boards of education, and supervising principals of schools, with the result that, in the newly built schools, these departments occupy a prominent place. Equipment has been selected with great care so that the district may conform to the modern tendency for the expansion of these subjects and yet save money by not buying unnecessary equipment.

Plans for the new departments, properly locating the equipment, are drawn by those of the state department having supervision of this work. These plans are then submitted to the school architect, who incorporates them into the general plan of the new building.

In order to comply with the aims of industrial arts in our schools, a new type of shop has appeared. This shop is known as a composite or general shop. It is called a "general shop" because several kinds of industrial activities are taught in one room. In our state several distinct types of general shops have been developed, their difference consisting largely in the variety and arrangement of equipment.

Because of its diversity of activities, the general shop possesses advantages over the older type of shop in a small community, because it takes the place of several shops without requiring additional teachers. While its inception sprang from the needs of the junior high school, it has been, and is being, organized in our grammar schools so that a period of exploration in diversified activities is possible in the intermediate grades. A shop equipped for several types of work provides experience with a variety of common tools and gives boys an opportunity to make things of greater variety and interest to them. The general shop provides exploratory manipulative experiences with several materials in a number of trades. These courses are not given with the idea of training a boy for specific occupation but for the purpose of permitting boys to find themselves through these tryout courses.

The program adopted for the general shop work usually includes woodwork, metal work, elementary electricity, cement work, household mechanics, and auto mechanics.

In the general shop, projects in wood still hold the most important place and receive more attention from teachers than is given to other shop subjects. A more careful study has been given to this subject and boys are required to learn many more operations in woodworking than formerly.

There has been a noticeable change in the design of the woodworking projects made in the school shop. This is shown by a greater refinement of line and weight. Eighth grade and high-school boys are making Italian Renaissance tables, tip-top tables, highboys, spinet desks, grandfather clocks, radio cabinets, and radio speakers. Projects of this kind require greater supervision on the part of the teacher and higher standards of workmanship from the boys.

Metal is rapidly taking the place of wood in many industries. This change has also affected the type of projects for industrial-arts purposes. Boys are now making very attractive iron tables, fern stands, umbrella racks, hanging baskets, lanterns, magazine racks, smoking stands, bridge lamps, mail boxes, fireplace sets, candlesticks, and many other practical projects, such as galvanized sheet-iron window refrigerators and camp stoves which fold into a small compass.

Another activity which has registered favorably in the general shop, is electrical work. Boys are interested in making electric toasters and heaters, and in working out problems in simple lighting circuits, doorbell circuits, the wiring of table and floor lamps, making small motors, transformers, and radio sets. Some teachers have put up rough frames in one corner of their shops, where side-wall and ceiling exercises in wiring can be conducted. This electrical work also includes the study of the principles and facts about currents, conductors, batteries, and circuits.

A study of the history of cement, its use and the industrial processes required to produce cement, affords an interesting shop activity. Boys are taught the various mixtures required for building purposes, and this study is illustrated through making ornamental flower boxes, garden furniture, and other practical problems.

The diversified equipment of the general shop enables a teacher to instruct boys in home mechanics. This subject includes a variety of experiences useful for the upkeep of the home. In this course, the boys are required to sharpen tools, repair locks and faucets, wire bells and lights, set hinges, hang doors, set glass, repair weighted window sash, replace or fasten loose rungs in chairs, and repair some of the electrical household appliances for the home.

Discarded auto motors have been secured and brought into the school shops and mounted upon stands to aid the student in his study of automobile engines. In the same way carburetors, ignition, cooling systems, starting and lighting, clutches, transmissions, radiators, storage batteries, fuels, and lubricants have been studied.

The general shop has made it possible for boys to receive a better industrial experience, because they have learned how to work with wood, sheet and band iron, a variety of electrical materials and the materials required for making concrete projects.

NEW MEXICO DIVISION OF TRADE AND INDUSTRIAL EDUCATION, 1929

D. W. Rockey, State Supervisor of Trade and Industrial Education, Albuquerque, New Mexico

New Mexico is primarily an agricultural state with stock raising for many years its principal source of revenue. Depression in price of livestock and nearly ten years of unprecedented drouth resulted in a period of financial depression and shrinking land values, from 1918-1927.

Offsetting these factors is the steady development of these communities lying off the main-traveled highway, brought about by the building of better roads and by the publicity that was given to the archeological resources of the state. In the face of these conflicting influences, there has been a steady growth in the educational development of

the state. High schools have been established at central points in the rural community, and students have been brought to these schools by operating a daily truck service which totals hundreds of miles.

Up to the present time, educational development in the state has been largely that of making available to the students the fundamentals of an academic education. Each year, however, renewed emphasis is given to the development of the industrial arts and vocational education. Within the past three years, the number of schools receiving state and federal aid under the provisions of the National Vocational Education Act has doubled. Industrial-arts departments, as a rule, are being established in the majority of high schools of over 60 enrollment. The size of these departments in school systems is such that no very closely analyzed cost data is maintained.

PROGRESS OF VOCATIONAL EDUCATION IN THE STATE OF NEW YORK

R. D. Fleming, Bureau of Industrial Education,
Albany, New York

The program of industrial and technical education in New York state during the year 1928-29 attracted widespread interest. This was due to a number of reasons. Remarkable industrial activity was witnessed in the business world. Industrial education was on a higher plane than ever before. There was an unusual demand for skilled workers. Junior high schools continued to develop, and the public demanded that the educational needs of those who are to enter upon industrial employment should be met by the public schools. Industry, too, recognized the valuable contribution which industrial education has made to the development of the State of New York.

Unit Trade Schools

The total registration in day trade schools of the state during the year was 12,114; 9,236 boys and 2,878 girls. There has been a steady growth in registration in these schools during the past decade, the enrollment increasing from 5,941 in 1918-19 to 12,114 in 1928-29.

Trade Courses Offered

Trade schools and industrial high schools in the state during 1928-29 offered a total of 53 different unit trade courses, 46 for boys and 7 for girls.

Within the past twenty years, day industrial and trade-school programs have been improved and extended. The number of schools in operation has largely increased. Buildings of modern type have been provided. The New Seneca Vocational High School in Buffalo has more equipment for instructional purposes than all the other vocational schools of the state combined had in the year 1908-09.

Evening Apprenticeship Training

Evening apprenticeship training during the year 1928-29 was provided in 21 cities for the benefit of apprentice workers in a wide variety of trades. The enrollment in these courses aggregated a total of 8,435.

Day Apprenticeship Training

The advantages of having apprentices attend day classes for instruction in related subjects is becoming more and more apparent. Syracuse is now on its second year of day courses. These courses have met with the approval of local employers and the program established has attracted widespread attention throughout the state and in other states.

Types of Apprenticeship

There are three distinct types of apprenticeship in New York state, each of which has desirable features suited to certain communities:

I. *Private Corporation School.* This is organized by the employer and carried on within the plant at the expense of the employer. The corporation apprentice school may be of the following types:

1. A separate training school is set up independently of the plant proper for the instruction and training of apprentices.

2. A type of training in which apprentices are assigned to the various departments under well-qualified foremen who, with the apprentice supervisor, sees that the boy receives proper instruction in the manipulative skills of the trade.

II. *Cooperative Apprenticeship Plan.* In this plan vocational trade and technical-school pupils are placed in shops on a week-about, or month-about basis. They are assigned in pairs, one being on the job while the other is attending school. Rochester, New York, and Seneca Falls, have

recently organized a cooperative apprentice-training program of this nature.

III. *The Small Shop.* In this type of apprenticeship training, the shopwork in all divisions of the trade is given in the plant, but on account of the small number of learners, which makes it impossible to employ a full-time teacher of related subjects, the apprentices are sent to day school for not less than four hours a week, or to evening school for two hours per evening, twice each week.

IV. *The Syracuse Plan.* In Syracuse, where several industries of the same type are found, it has been considered desirable to establish day apprentice schools where several trades may be taught. The board of education of that city has appointed a full-time apprentice supervisor to organize trade courses and handle the details of coordination and placement. An apprentice committee composed of both manufacturers and representatives of organized labor, together with one representative of the public schools, selects all apprentices, handles cases of attendance and transfer, and offers suggestions in case of agreements made and differences arising between employers and the workers.

The survey of prospective fields of apprentice training in the state has brought to light the fact that very little has been accomplished in training apprentices in the bakery, tailoring, textile and jewelry trades.

The possibilities in the bakery trade are shown by the fact that the part-time school at Olean has been conducting a course for apprentices in the bakery trade, for the past year. The school provides the related work, and the trade itself teaching the manipulative skills necessary.

New York City is the only city in the state which has endeavored to give apprentice training in the merchant-tailoring trades. Recently the merchant tailors of New York City have taken definite steps to establish apprentice classes in that trade at an early date.

Unit Technical High Schools

The unit technical high school has proved especially attractive to students in the city of New York. In that city such a large number of students were interested in the junior-engineering courses, that it was found necessary to erect new buildings for both the Brooklyn Technical High School and the Textile High School in Manhattan.

Other technical high schools in the state are located in Brooklyn, Manhattan, Buffalo, Utica, and Yonkers. These five schools show a total registration of 5,576 students for the year 1928-29.

Part-Time Schools

In the part-time schools of the state for the year 1928-29, there were registered 164,905 boys and girls of the ages 14, 15, and 16. This was 3,472 less than for the previous year. Of the number, 89,574 were boys and 75,331 were girls. For the instruction of these employed children 758 full-time teachers and 426 part-time teachers were employed by the various cities and districts of the state. Total salaries paid these teachers amounted to \$2,277,006.

Decreased enrollment in the part-time schools of the state is noteworthy, because this is the first time since the school year 1920-21 that there has not been a relatively large growth in the number of students in these schools. It is probable that the part-time schools in the state have attained their maximum size. There are a number of reasons which may be offered in explanation. The day of juvenile employment for the 14- and 15-year-old boy and girl is passing. The office boy of the Horatio Alger type is no longer in the picture, nor is he welcomed in many of the large industrial, commercial, and other forms of business enterprise in the state. Raising of the age level at which young people enter employment is characteristic of our day. This has come about not only through the development of equipment and machinery which makes the services of young people unnecessary, but also through the raising of standards by the American people, which has been reflected in a longer school attendance of the average boy and girl. Secondary schools are becoming attractive to young people and many youths now prefer school attendance to employment. Prosperity which has been fairly prevalent throughout the state has caused parents not only to wish to be able to keep their children in full-time school, but has also given them sufficient money to do so.

Placement

One of the important services which the part-time school leader is doing, is that of placement. Each year teachers and placement workers in the state have effected a closer relationship between schools and employers, which means that they are able to select the kind of jobs best suited to the interests, needs and capacities of the young people who

come to them for help. The record of the placement department of the Boys Continuation School of Buffalo is typical of what is being done throughout the state. In that city, employment was found for 1,012 boys during the year.

Health Service

An interesting experiment in health service for employed children was undertaken by the West Side Continuation School of New York City in 1926, in cooperation with the health, commercial, and other public boards. From May 3, 1926, to June 30, 1929, 8,343 children were examined, 6,012 were referred for treatment and 5,022 were reexamined for follow-up. The children who had impairments were referred to various cooperative clinics, hospitals, dentists, and physicians. A thoroughly organized follow-up of each child found to have impairments was made. A course of study in health education was prepared to meet the needs of continuation-school pupils. Records and forms for continuation-school health purposes were developed so that they could be used with only minor revisions in any school attended by working children.

Of the impairments found among these children the most important in point of numbers were as follows: 3,571 were dental, 1,814 vision, 1,613 orthopedic, and 1,115 lack of nutrition.

Homemaking Education in Part-Time Schools

The part-time school for girls in the state is now in its eighth year. The homemaking teacher helps the girls, first, to secure employment, and second, teaches them how to progress in the business world. This means an analysis of the girls working, recreational, and home life.

The homemaking teacher has helped the part-time school girl in forming right habits of dress, sleep, and recreation; how to select and care for her clothing; and how to get the best values in making purchases. The girl who contemplates marriage has been helped in planning and furnishing a small home at minimum cost. As the average girl is to become a homemaker, the teachers of these subjects have laid stress on home life and the care and training of children. With the assistance of the school nurse, lessons on the physical care of the baby and the preschool child have been given in all schools throughout the state.

In Mt. Vernon the school administrators have sanctioned the construction and furnishing of a homemaking apartment in order to give part-time school girls instruction in this subject.

TRADE AND INDUSTRIAL EDUCATION FOR 1928-29

George W. Coggin, State Supervisor of Industrial Education, Raleigh, North Carolina

The trade and industrial division has moved ahead, both in number of classes and in enrollment, in spite of the handicap in our evening-school program caused by the influenza epidemic and the industrial situation. A splendid corps of local supervisors and instructors deserve the credit for this advancement under such an unusual combination of circumstances. Industry has continued to give us splendid cooperation. Many large plants consider their educational program an essential part of their organization. In several instances where funds were not available for enlarging the program, the industry has taken over the work and continued it on a more intensive basis.

Our activities have been confined solely to promoting part-time and evening-school programs since the limited funds available have been taken up with this type of instruction. We have been forced to reduce the amount of reimbursement for part-time schools in order to meet the increased demand. Further reduction will work a hardship on many of the schools, as they are carrying a heavy load for the funds available.

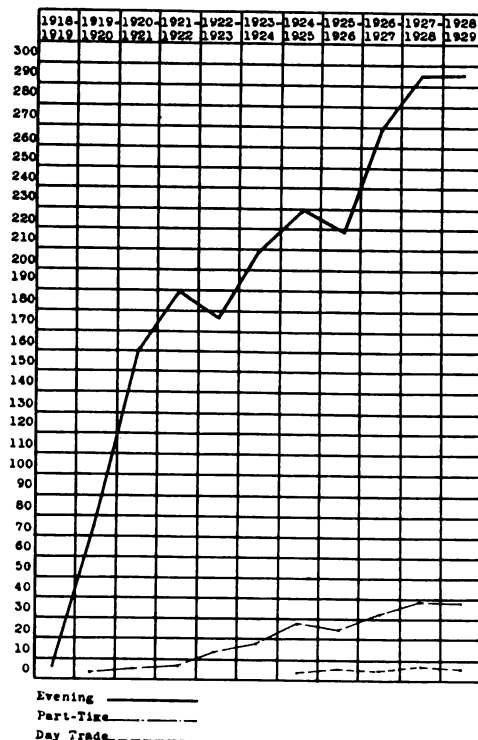
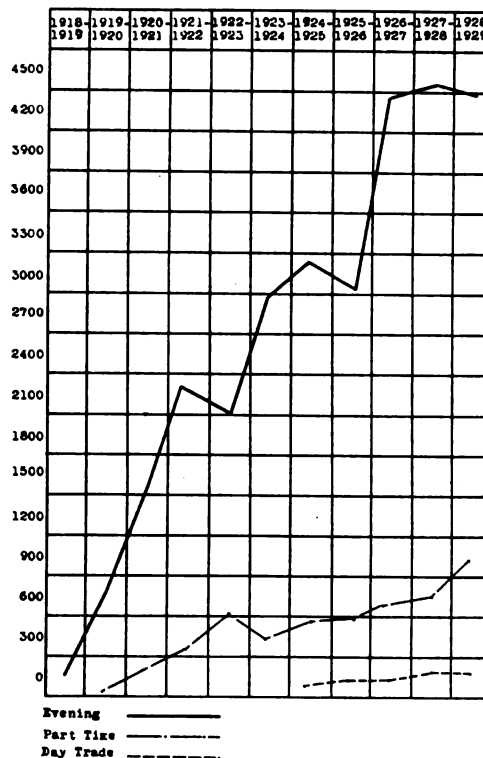
State Supervisory Staff

1. The state supervisory staff remains unchanged. We have been able, however, to increase the number of local directors. This increases the efficiency of the program in that the local men are better able to serve the needs of the community and give the teacher training to tradesmen

necessary for teaching short-unit courses in evening schools.

2. The assistant supervisor has devoted his time to promoting evening textile classes. He has his headquarters near the center of the textile industry of the state. By

GROWTH OF TRADE AND INDUSTRIAL EDUCATION IN NORTH CAROLINA, 1918 TO 1929 ENROLLMENT



using a car he has been able to train the instructors individually during the day and visit their classes during the evening, thus keeping in closer touch with the program. He was also able to inspect the part-time classes in his region and advise with local directors.

The negro teacher trainer at Agricultural and Technical College, Greensboro, spent a part of his time in the field

GROWTH OF TRADE AND INDUSTRIAL EDUCATION IN NORTH CAROLINA

GROWTH OF TRADE AND INDUSTRIAL EDUCATION IN NORTH CAROLINA											
1918-1929 Classes											
	1918-1919	'20	'21	'22	'23	'24	'25	'26	'27	'28	'29
Evening Classes	5	74	160	189	176	209	229	217	269	295	298
Part-Time Classes .....	..	2	4	6	13	18	26	25	31	37	39
Day Trade Classes.....	..	..	..	..	..	..	4	6	6	8	7
Total No. Classes.....	5	76	164	195	189	227	259	248	306	340	344
Enrollment											
	1918-1919	'20	'21	'22	'23	'24	'25	'26	'27	'28	'29
Evening	128	775	1562	2309	2101	2954	3216	3081	4425	4531	4438
Part-Time .....	..	31	163	376	614	492	574	599	714	752	1083
Day Trade .....	..	..	..	..	..	..	102	125	110	172	168
Total	128	806	1725	2685	2715	3446	3892	3805	5249	5455	5689

working with communities and classes, under the direction of the state supervisor. He also had the general supervision of the day trade classes at Agricultural and Technical College.

3. Promoting evening and part-time classes has constituted the major part of our activities. We are promoting standardized training schemes for industry, such as the textile, public service, railroads, etc. This plan will also be carried out in cooperation with other states.

The day trade program will be maintained only in centers where there seems to be a special reason for its existence. For example, the day trade school at Agricultural and Technical College seems to function owing to the fact that colored boys and men throughout the state are able to enter at any time during the year, stay as long as is necessary, and return to their job when they have sufficient training, or economic conditions make it necessary. In this way they are able to learn such trades as bricklaying, carpentry, etc., when these courses could not be offered in isolated communities in which they live.

Conferences

Conferences have been held with supervisors and teachers wherever sufficiently large groups could be secured.

Our state teachers' association has a vocational section. At this meeting we are able to get our local directors together to discuss their problems. A number of our part-time commercial teachers attended the commercial section of the teachers' association.

The state supervisor and assistant supervisor attended the regional conference in Memphis.

Publications

Publications consisting of news letters, material on standard textile courses, and foreman-training conference reports were issued.

Teacher Training

Teacher-training courses have been maintained at State College for engineering students. The group was composed for the most part of textile seniors. By special provision in our state plans, these men are allowed to teach related textile subjects in evening schools before they have had two years' experience in the industry.

Agricultural and Technical College has also maintained a teacher-training department.

Our most effective teacher training has been carried on with instructors selected from the industry. These men are very apt and have shown splendid spirit in attending teacher-training classes wherever available. Only a few life certificates have been earned on account of the time requirement in the state plan. Those who have finished the work, however, are always glad to attend conferences whenever opportunity is given.

Vocational Training for Girls and Women

Classes in dietetics and other phases of nursing have grown in popularity during the past year. Courses for practical nurses among the colored women have an attendance record very much above the average. This work is rendering very efficient service to the communities wherever organized.

Vocational Training by Industries

Industries throughout the state are maintaining, to a large extent, vestibule schools for training those entering their employ. This has grown to such proportions that it is impossible to compile reliable data.

Commercial Education

General continuation classes in commercial work con-

tinue to be popular, especially in the smaller cities where business colleges are not available. The schoolmen are glad to arrange their programs so as to give a part of the teachers' time for such instruction. By this means, students who have completed high school and entered employment are able to secure the training necessary for promotion.

Courses in salesmanship have been abandoned as far as the state department is concerned, since the larger stores have realized the value of such training and have employed educational directors at their own expense.

The commercial-education program is under the supervision of the state supervisor of industrial education. Most of the instructors are experienced commercial teachers, so the teacher-training program in this field has not seemed necessary except to give them a thorough understanding of the part-time plan and the requirements for conducting such work, if aid from the vocational board is expected.

The larger cities in the state have commercial evening classes doing splendid work. Data is not available, however, since these cannot be reimbursed under the Smith-Hughes Act.

VOCATIONAL EDUCATION IN NORTH DAKOTA

Edward Erickson, State Director for Vocational Education, Grand Forks, North Dakota

I. Vocational Agriculture

For the year 1928-29, 42 schools had Smith-Hughes vocational-agricultural departments. The total salary paid to agricultural instructors was \$90,978. The federal aid was \$30,353.01.



EDWARD ERICKSON

State Director for Vocational Education
Grand Forks, North Dakota

A total of 957 boys and 43 girls were enrolled in the vocational-agricultural departments.

II. Home Economics

In home economics there were 23 all-day departments, three evening, and one part-time department. The total salary paid the home-economics teachers, counting vocational time only, was \$17,084.27. The reimbursement was: federal, \$4,000, and state, \$2,000.

The total enrollment in home-economics courses was 1,182.

III. Trade and Industrial

The trade courses were given at the State Agricultural College and the State School of Science. Eight Smith-Hughes courses were reimbursed out of federal funds. These were power machinery and auto mechanics at the Agricultural College; and bricklaying, plumbing, electricity, auto mechanics, printing, and aviation, at the State School of Science. The total salary paid teachers in trade courses was \$26,924.36. The reimbursement out of federal funds was \$8,000.

The total enrollment in Smith-Hughes trade and industrial courses was 272.

The grand total amount of federal, state, and local funds spent for vocational education for the year ending June 30, 1929, was \$124,532.27.

IV. Teacher Training

The State Agricultural College is the teacher-training institution for agricultural and home-economics teachers. The state university also prepares teachers qualified to teach in the Smith-Hughes home-economics departments but receives no federal subsidy. The State School of Science is designated as the teacher-training institution for trade and industrial teachers.

V. Other Industrial Courses

The State Normal and Industrial School at Ellendale, North Dakota, has a mechanic-arts department. This department offers thorough training in wood and iron work, in elements of farm and shop machinery, and in gas and steam engineering, and also training to teach these subjects.

TRADE AND INDUSTRIAL EDUCATION IN OHIO

E. L. Heusch, Supervisor of Trades and Industries,
Columbus, Ohio

General Survey of Situation Within the State

The statistical report indicates a wide range of vocational classes during the fiscal year. Evening classes, both manipulative and related, were held in the principal industrial cities of Ohio. Foremanship classes under trained leaders were extensively developed throughout the state. An increasing number of coal-mining extension classes were carried out in eastern and southeastern Ohio.

The day unit-trade program supplemented by a cooperative plan has included more units and a greater enrollment than during previous years. The cooperative enrollment has especially increased over that of last year. Part-time trade-extension classes have increased in number covering more units than ever before.

Teacher training, including conference-leadership courses, has functioned in every particular. Ohio has provided a systematic program for the professional improvement of vocational instructors in trades and industries. The state plan makes adequate provision for formal professional courses and in addition particularly provides informal specialized professional assistance to instructors in service.

The outstanding development during the past year was the organization of a new program for employee training in industry. The state has been divided into four sections, and in each section a district coordinator is assigned to offer a service directly in industry on a part-time trade-extension plan. All factors necessary in setting up a plant training program are carefully studied by the district coordinator before there is any attempt to formulate a training program in any industry.

For the first year in this new program, only the smaller industrial cities will be offered this new service. In each district, a group of fifteen communities are indicated, and the entire effort of each district coordinator will be given to the industries in those communities. It is expected that the employee-training program, hooked up as it is directly with the industries, will provide a really effective vocational-training program in such communities. The coordinator's service in each industry will continue until the course is outlined, and until teachers are developed in each industry to carry on the program. A close contact and follow-up program will, of course, be a part of the program.

The district coordinators are under the direct supervision

of the state supervisor of trades and industries, reporting biweekly to him of all activities during each two-week period. Further, a general meeting at least one each month is called in the state office at which all district coordinators assemble for guidance and instruction.

Briefly, the duties of each district coordinator may be outlined as follows:

1. Promoting with industries an interest in employee education in the manufacturing industries. Assisting industry in better organizing their own programs of training and encouraging such programs if not already established.
2. Assisting apprentice instructors, journeymen, and others in organizing their program of training, both manipulative and technical in character.
3. Instructing apprentice classes and follow-up programs of training after plant instructors have been prepared to continue instruction.
4. Submitting reports, as required, on forms provided by the state supervisor of trades and industries.

Teacher Training

A brief review of trades and industries teacher training may be indicated as follows:

In July, 1927, the state board for vocational education, division of trades and industries, brought together the three municipal universities—Toledo (northwestern Ohio), Cincinnati (southwestern Ohio), and Akron (northwestern Ohio)—each to act as a center for vocational teacher training in trades and industries, for its district, under the supervision of the state office.

The duties of each teacher trainer include the following:

1. Conducting of formal courses as set forth in the Ohio plan for which credit on certification is provided. These courses shall be scheduled at convenient hours for teachers in service.
2. Conducting of informal specialized work with individual teachers on the job. This type of service shall occupy at least 35 per cent of the employed time of the teacher trainer.
3. Participating in special conferences called by state board.
4. Conducting extension training, both formal and informal, in cities in the district outside of teacher-training center at least three days each week.
5. Submitting reports as required to state supervisor of trades and industries.

During the fiscal year, each teacher trainer averaged 48 hours a month in offering formal professional courses as provided in the state plan for vocational education and 48 hours each month in giving informal teacher-training services. These figures do not include time spent in office work, study, and travel, as each district teacher trainer was assigned both formal and informal work in the larger cities of each district outside of his own particular center.

The outstanding feature of the teacher-training program during the year, was that each teacher trainer followed up the formal work with individual help, much time being devoted to the individual classroom teachers with their daily problems. This informal participation on the part of each teacher trainer has in large measure made the teacher-training service an effective and successful organization. While the formal courses are necessary to meet state certification requirements, it is quite obvious that the informal work involving job-sheet construction, the devising of record systems and progress charts, introducing new methods, setting up courses of study, ordering of equipment, and giving demonstration teaching, were extremely valuable and gave splendid returns.

A number of specific teacher-training courses were held at the state capitol during the summer. Separate trade groups were especially provided for under such an arrangement.

A week's intensive conference (6 hours daily) was provided for teachers of plumbing and steam fitting. Another, of like duration, for teachers of shop and related automotive courses. Another for teachers of machine-shop work. These courses were especially valuable because the groups were segregated along the lines of each particular activity.

In addition to the fall and winter courses in formal teacher

training in the score of centers of Ohio, and in addition to the separate trade groups teacher-training courses at the state capitol during the summer, there were provided summer courses (6 weeks term) in each of the three municipal universities under the instruction of the district teacher trainer.

Foreman Leadership Conference

The trend in foremanship education is toward a more practical type. Foremen want to discuss their own plant or departmental problems. They see the need for better understanding and greater knowledge pertaining to the solution of their own problems. It is not difficult to interest foremen in foremen conferences when the topics are of a practical nature.

During the past year, several conference-leadership conferences have been conducted with an enrollment of 192 men. A large number of foremanship courses have been conducted serving about 1,500 foremen.

In this way retail meat dealers, the metal trades, plumbing, furniture, sugar industry, railroad, steel mills, sewer pipe, auto industry, and the public utilities were served during the past year. Several state conferences also were held for conference leaders. This type of service provides an opportunity for the conference leader to meet in conference with other experienced leaders. Topics of vital interest to those men were discussed. Also sample conferences were conducted by these leaders and a complete report was developed to be given to conference leaders of the state.

In addition to training leaders and conducting foremanship courses, there is carried on some work in the nature of conducting sample conferences, offering suggestions on the development of foremanship courses, and giving talks to groups of foremen or foremen clubs.

As a result of this program, industries are agreed that the foreman knows and understands his responsibilities better, that there is better cooperation, less accidents, and a greater appreciation for training of apprentices. In other words, the foreman is becoming a better instructor and a more effective worker. Results and requests from industry indicate that an expansion of the foremanship-training program would be worth while and welcomed.

Girls and Women in Industry

Through our newly developed employee-training-in-industry program, Ohio will definitely meet the needs of girls and women in industry. One of our first programs was for the employees of the Van Horne Tube Company at Franklin, Ohio. Here, only girls and women are employed. After a very thorough study of the plant by a district coordinator, a training program was outlined. Two of the outstanding women employees—one for related and one for shop instruction—were prepared for the teaching positions under careful instruction and supervision of the district coordinator. These two women instructors, who were highly qualified industrially because of their knowledge of the product of industry, were developed into very good teachers.

Similar programs of employee training are being organized in industries throughout the state, so that experienced

workers may be developed from inexperienced help. This not only increases production and the quality of the product, but also assures the employee a higher rate of pay.

Commercial Education

A. Retail Selling

Retail-store-service training on a cooperative and part-time trade-extension plan has reached two particular groups.

1. Those already employed and who are provided definite training supplementing their daily jobs.

2. Those preparing for store service by enrolling in cooperative courses, alternating between store and school on a work-study basis.

B. Commercial

A number of commercial courses in office work were in operation on a cooperative basis in such cities as Dayton, Cincinnati, etc.

In a few cities, commercial courses were set up directly in the offices of industries where instruction in office practice was provided on a four-hour-a-week basis. These programs were sponsored by local boards of education in cooperation with the state board.

Summary

The outstanding features of the 1928-29 program in Ohio may be listed as follows:

1. An effective program for training conference leaders in the many industrial pursuits, such as metal-working plants, clay products, automotive, sugar refining, retail meat dealers, etc.

2. The continued successful operation of the teacher-training program as set up in the Ohio plan for vocational education.

3. The establishment of the employee training in industry service by the employment of district coordinators in the four sections of Ohio.

4. The many district conferences of teachers in service for a definite discussion and study of their particular problems.

5. A definite provision for research and study of such items that will definitely promote a better program of vocational education.

TRADE AND INDUSTRIAL EDUCATION IN OKLAHOMA

Scott J. McGinnis, State Supervisor of Trade and Industrial Education, Oklahoma City, Oklahoma

The State of Oklahoma is making rapid progress in the development of its program in industrial education. For the fiscal year 1928-29, the enrollment in all types of classes was materially increased over that of the previous year.

During the session of the last legislature, the department of vocational education was consolidated with the department of education. Both departments are now under the direction of the state superintendent and operate under one board.

The Oklahoma A. and M. College, at Stillwater, is now designated as the teacher-training institution. Both resident and extension courses will be offered.

The following table shows the progress made during the year ending June 30, 1929.

Cities	No. D. T. Classes	No. P. T. Classes	No. Evening Classes	No. Enrolled		No. Teachers		Funds Spent for Classes		
				M	F	M	F	Federal	State	Local
ARDMORE*	..	6	5	84	60	10	..	\$ 377.00	\$.....	\$ 377.00
BRISTOW*	..	..	2	31	..	3	..	50.00	.....	50.00
CHICKASHA*	..	12	1	86	97	6	4	988.99	.....	988.99
WILBURTON	..	..	13	390	..	13	..	767.00	.....	767.00
EL RENO*	..	6	4	79	60	4	6	598.50	.....	598.50
ENID*	1	9	11	283	80	15	2	2,427.00	.....	2,427.00
EDMOND	1	..	..	11	..	1	..	187.50	.....	187.50
FAIRVIEW	..	..	2	62	..	2	..	300.00	.....	300.00
LAWTON*	..	4	1	92	38	3	..	920.00	.....	920.00
MUSKOGEE*	..	11	1	52	103	3	2	630.25	.....	630.25
TULSA*	..	8	26	875	299	21	13	4,014.62	.....	4,014.62
STILLWATER	..	..	4	116	..	4	..	162.00	.....	162.00
OKLAHOMA CITY*	2	13	13	595	169	15	10	2,090.19	987.50	3,077.69
OKMULGEE*	..	11	3	91	134	10	3	523.00	.....	523.00
DRUMRIGHT	..	6	..	144	..	3	3	729.16	1,888.88	2,618.04
PONCA CITY*	..	10	43	1,021	233	49	4	7,160.33	.....	7,160.33
SAND SPRINGS*	..	2	..	56	44	2	..	291.00	.....	291.00
CLINTON	..	6	..	..	60	3	1	202.50	.....	202.50
DUNCAN	..	8	..	..	80	3	6	300.00	.....	300.00
McALESTER	..	8	..	..	79	9	1	692.50	.....	692.50
SHAWNEE*	..	10	..	..	130	..	10	611.00	.....	611.00
LANGSTON	2	..	32	..	2	..	..	..	750.00	750.00
*LOCAL SUPERVISION	..	..	..	..	..	..	..	..	8,260.99	8,260.99
TOTALS	6	130	161	4,068	1,668	179	65	\$24,022.54	\$11,887.37	\$35,909.91

VOCATIONAL EDUCATION IN RHODE ISLAND

**Charles Carroll, Director of Vocational Education,
Providence, Rhode Island**

In our program for 1929 we specially stressed evening schools, because we believed that the work in evening supplementary classes for adults and youth tends to become the most practical and efficient, and to produce the largest



CHARLES CARROLL
Director Vocational Education,
Providence, R. I.

immediate return. We also promoted the organization of evening classes for farmers in new centers, with the purpose of reaching some not yet touched; for home-economics classes in villages and small communities, because the work in larger cities and towns is on a substantial basis and has justified itself so far as to need no further promotion; and for trade and industrial classes in occupations not previously touched. We find that there is a growing interest in industrial education for youths who, as apprentices, are learning only parts of a trade, and subsequently realize that they need more training. In the textile field the depression in New England has awakened factory managers and employers to the need of new processes and new lines, and both are having recourse to the schools. There is a growing interest in industrial chemistry, and the automobile industry is constantly suggesting new lines of expansion. We find the general outlook for vocational education such as to encourage us to anticipate more and better classes.

**TRADE AND INDUSTRIAL EDUCATION IN
TENNESSEE**

Jas. Arentson, Industrial Supervisor, Nashville, Tennessee

There has been a very satisfactory increase in all types of vocational trade and industrial classes provided for in the state plan.

1. The points that are being especially emphasized in the unit-trade classes are the improvement of instruction and placement. A larger percentage of day-trade pupils are being satisfactorily placed in jobs for which they have received training.

2. The problem of organizing evening schools in the small industrial centers is being given especial attention and some progress is being made.

3. The enrollment in part-time classes for the past year increased more than 39 per cent over the preceding year. Most of the increase was in the general continuation type of classes in the larger centers. It is becoming increasingly difficult to conduct part-time schools for juvenile workers in small centers.

4. An annual six-day conference for part-time teachers was held at the University of Tennessee. Dr. R. L. Cooley of Milwaukee, Wisconsin, was a member of the University summer-school staff at the time the conference was held and contributed much to its success.

5. Extension courses for teachers were conducted in five centers under the direction of the state teacher trainer,

who is also professor of industrial education of the University of Tennessee. Residence courses were offered both in the regular and in the summer session.

6. Advanced courses of graduate rank are open also to qualified undergraduates. The enrollment in these classes of men experienced in the field of industrial education has been very gratifying.

7. The following summary shows the enrollment in all types of vocational classes for the past two years:

	Enrollments	
	1927-28	1928-29
Evening schools and classes.....	1,690	2,006
Part-time trade-extension classes.....	420	485
Part-time general continuation classes.....	827	1,153
Day unit-trade classes.....	215	300
Foreman conferences.....	52	40
Totals	3,204	3,984

TRADE AND INDUSTRIAL EDUCATION

**N. S. Hunsdon, Supervisor of Industrial Education,
Austin, Texas**

General Survey

The year 1928-29 has been a very successful one from the standpoint of results. Both evening trade-extension class-work and part-time education have been increased considerably while the day-trade program has decreased. This means that the people who are in industry and at work are the ones who are getting the greater benefits from the trade and industrial funds. This is a situation which we have always felt should exist.



N. S. HUNSDON
Supervisor Industrial Education,
Austin, Texas

Sixteen new towns were added to the list of those carrying on trade and industrial education during the year, making a total of 43 cities that are now carrying on this work. Three hundred and four classes were organized and a total of 279 teachers were employed to conduct the work. The total enrollment of 6,104 in all classes was very gratifying. This enrollment represents separate individuals.

The City of Waco introduced vocational trade work into its school system during 1928-29. Only evening and part-time classes for employed people were offered, but the results were so satisfactory the work will be continued.

Houston's program was greatly expanded by putting on a separate director of vocational education who has been very successful in having the evening and part-time program greatly increased. Also through the cooperation of the labor groups, committees have been formed to help in promoting the vocational program for the apprentices and journeymen in all lines of industry. Contracts for a new vocational trade school have been let so that Houston will soon have a well-established trade and industrial program under the supervision of Mr. Charles A. Johnson, local director.

During 1928-29 the teacher-training department of the University of Texas held two very successful foreman conferences, one at the Magnolia Refinery at Beaumont and one at the American Smelter and Refining Company's plant

at El Paso. As a result of these conferences teacher-training programs were developed and a number of teachers were put to work on trade-extension classes.

The A. and M. College teacher-training department held a two weeks' plumbing instructors' conference in November, 1928, with nine men in attendance. As a result of this program, one part-time plumbing class was organized at San Antonio and an evening trade-extension class was conducted at Fort Worth.

For the year 1929-30 the outlook is very encouraging. Funds for trade work have been applied for to such an extent, that a reduction in the proportion of aid has been found necessary to meet this demand.

It is an interesting fact in connection with a \$3,700,000 bond issue for schools in San Antonio in July that an effort was made to try to avoid spending so large an amount for vocational education. The bonds carried by a large majority however, hence San Antonio will have a fine trade school by 1931. This school also will offer opportunity, part-time, and evening-school work for both boys and girls.

As a further result of the trade work in vocational education, the legislature has finally accepted the rehabilitation act and appropriated \$25,000 for the next two years for this work.

Summary

The following table is a summary showing at a glance the work of the trade and industrial section for the year 1928-29.

Statement of Trade and Industrial Work for Texas for 1928-29
Ending June 30, 1929

	Cities	Classes	Enrollment			Teachers	
			M	F.	Total	M.	F.
Evening	20	161	2875	450	3305	113	17
Part-time (Trade							
Ext. and Prep.)..	12	64	479	720	1199	56	32
Part-time (Gen.							
Continuation)...	21	38	249	539	788	10	24
Day	12	41	782	30	812	53	4
Total	43 (Dif.)	304	4385	1719	6104	*232	77

*With no duplications, teachers are as follows:

	Male	Female	Total
White	187	56	243
Negro	15	21	36
	202	77	279

Funds Spent for Classes

	Federal	State	Local
Evening	\$11,453.77	\$ 8,971.77	\$ 6,832.91
Part-time Tr. Ext.....	26,141.20	18,285.27	16,250.64
Part-time Gen. Cont.....	8,346.41	5,868.73	4,490.65
Day	18,358.10	16,523.15	30,891.11
Total	\$64,299.48	\$49,648.92	\$58,465.31

Teacher Training

Institutions	Teacher Trainers		Enrollment	
	Male	Female	Male	Female
A. and M. College.....	3	..	122	17
University of Texas.....	1	1	9	..
Prairie View College (Col.)...	1	..	63	6 Conf.
			270	Foreman
			8	24 Conf.
	5	1	193	
			279	
Total Spent	Federal	Institution		
\$26,920.56	\$8,719.25	\$18,201.31		

VOCATIONAL EDUCATION IN VERMONT

Clarence H. Dempsey, Commissioner of Education,
Montpelier, Vermont

The vocational program of Vermont includes work in agriculture and home economics in selected high schools, where courses are given in accordance with federal requirements. The number of schools giving such agricultural courses at the present time is twelve, and the number of schools giving vocational home economics is eight. These numbers are slightly larger than one year ago.

Three years ago an important vocational school was started in Barre for granite-cutting apprentices. It has

proved quite successful, and may well be looked upon as a model for similar schools elsewhere.

Beginning September, 1929, two Smith-Hughes vocational courses have been organized in the towns of Wallingford,



CLARENCE H. DEMPSEY
Commissioner of Education,
Montpelier, Vermont

in connection with the American Hoe and Fork Company and in Windsor, with two large machine shops. For a number of years a successful school has been conducted on a four-year program in the town of St. Johnsbury, with the Fairbanks Scale Works; and at Springfield, in connection with several machine shops.

INDUSTRIAL ARTS IN WISCONSIN

H. W. Schmidt, Supervisor of Manual Arts,
Madison, Wisconsin

For the year 1929 there has been a slightly upward trend in the subject of industrial arts in Wisconsin. The number of schools offering the subject has increased by 12, although the number of special teachers has increased only from 286 to 289. The number of schools now offering the subject is 163. This is about 36 per cent of the total number of high schools in the state, but when it is remembered that over half of these high schools are in the smaller



HANS W. SCHMIDT
Supervisor Manual Arts
Madison, Wisconsin

and rural communities, the showing of the work in manual arts in this state is to be considered as quite satisfactory. The pupil enrollment has not increased very much, however, there being 23,843 during 1929, which is but 2 per cent greater than that of the previous year.

It is felt, however, that more important than this statistical material is the fact that a much better attitude has developed toward the subject both by educators and the general public. Up to within a few years ago, the influence of the war period was still in evidence, inasmuch as the

type of work done was more or less the outgrowth of this spirit. There was so much of the technical and skill side involved that the educational values of this subject were being lost sight of.

There were quite obviously two major directions in which a definite change was indicated or which at least called for a greater emphasis. One was the matter of valid and defensible educational objectives, and the other the means used to attain them which probably meant the offering of more diversified activities than had been the case heretofore, but even in the latter instance, modern educational principles could not be lost sight of.

As the outgrowth of a survey made two years ago and also through the demand which came from educators and quite a number of the more progressive manual-arts teachers in the state, it was found necessary to develop a state program based upon sound educational principles.

The first movement in this direction was the appointment of a committee of 25 to formulate objectives in manual-arts teaching which objectives were to be submitted to a statewide referendum. It is also the intention of the above committee to designate quite specifically the means which could be used to attain the formulated objectives. The third outgrowth of this program resulted in the rebirth of the Wisconsin Industrial Arts Association a year ago.

At present the progress has consisted in the submission of objectives to a referendum which will be available very shortly. The state Industrial Arts Association is undertaking the formulation of both an industrial-arts curriculum and a statewide suggestive course of study, both of which will be built up around these objectives. This work is now being prosecuted with vigor and apparently has the hearty support of all the special teachers as well as of the administrators in general.

The fact that many schools are changing their organization to include different time elements in their daily recitation period has also made it necessary to shift the emphasis of the special types of work. The change indicated calls for a reduction in the total time given over to the work in industrial arts and it, therefore, becomes necessary to shift the emphasis in directions which will permit utilization of a shorter time period with a higher degree of teaching efficiency. In plain words, it means that teachers will find it necessary to throw the emphasis upon the essentials of their subject rather than utilize the extensive type of approach possible under a longer time period. This is to be regarded as a healthful attitude.

In the training of teachers for the special subjects, it has been found necessary to pay some attention to those schools whose enrollment is too small to permit the employment of a full-time teacher. This means that these teachers must be prepared to teach some other subjects along academic lines or to serve as athletic instructors, the latter being the more prevalent. Due to the fact that nearly all schools preparing special teachers have gone on a four-year graduate basis, it has been found that the teachers of industrial arts are being better prepared to meet with practical situations. It has also resulted in a quite definite upgrading of the teaching force as a whole with a resultant better type of teaching.

There has been some progress in the physical equipment and rooms devoted to shop activities. In part, this is due to the erection of quite a number of new school buildings and also, in some cases, to a more liberal attitude by school administrators and boards. There is still much to be accomplished here, however.

The work in grades 7 and 8 is about in step with the rest of the work. Here, as elsewhere, a sounder philosophy should be in evidence. The adolescent and his mental and physical equipment should be given greater consideration. In quite a number of schools this problem is recognized and given due prominence in the conduct of the work and its diversity. In the smaller schools it becomes a problem not easy to solve. It should be met squarely, however, rather than allowed to go by in default, because the ten thousand boys involved in the work are worthy of the effort.

The whole industrial-arts situation is, therefore, to be

considered as very favorable, and it is hoped that the progress indicated herein will receive continued impetus in the near future.

PROGRESS IN WYOMING

F. M. Treat, State Director of Vocational Education,
Cheyenne, Wyoming

Nearly all of the high schools of Wyoming have industrial-arts programs. Some of these have given place to vocational farm shops. The industrial programs are entirely separate from the Smith-Hughes trade and industrial program. There is no state supervisor of industrial arts in Wyoming, therefore, it is hard to make any very definite statement concerning the industrial-arts program.

Vocational education in Wyoming is being carried on in three fields: viz., agriculture, home economics, and trade and industry. A full-time state supervisor is in charge of each field. Last year agriculture was taught in 30 schools to about 800 farm boys. These schools require well-equipped farm shops and laboratories. All boys must take farm shop and have a farm project. The cash returns from the farm projects last year was \$60,000. The evening and part-time agricultural program has shown the most development.

Vocational home economics has been organized in eighteen high schools in the state with an enrollment of 360. Evening and part-time classes are held in many centers. These classes reach the girls and women of the farms and small communities. In some instances the wives come to a home-economics class on the same evening that the husbands come to an evening class in farm shop or agriculture. The outstanding development this year has been the securing of a full-time state supervisor and a full-time teacher trainer at the University of Wyoming. This will make a greater development of the entire state program.

The program in Wyoming has been developed to a greater extent along agricultural lines, but the trade and industrial program is on the upbuild. Wyoming has only five all-day trade and industrial classes. Our greatest development has been along evening and part-time lines. Three cities in Wyoming have part-time evening-school directors who are extending the vocational program each year. Cooperative agreements have been entered into with local school boards for the organization and supervision of part-time classes for Union Pacific apprentices, railway firemen, and engineers, and nurses. This work is under the supervision of the state director of vocational education. Under the nurse-training agreement, a girl who enters hospital training before she is a high-school graduate may complete both hospital training and high school in a five-year period. A girl cannot enter nurse training in Wyoming until she has completed two years in high school.

The most outstanding single development that is showing best results has been the establishment of the school car for the instruction of railway firemen and engineers. This car is administered under an agreement between cooperating districts, the railway company and the state department of education, division of vocational education. A full-time instructor is employed, and he moves from town to town giving instruction to these men.

The greatest growth during the year and the one that has shown greatest results, is the holding of foremanship conferences. Six have been held during the past year. A larger group is already on our calendar for the present year. Those held during the past year are as follows:

1. Union Pacific Railway, Laramie.
2. Holly Sugar Corporation, Worland.
3. Chicago, Burlington and Quincy R. R. Co., Sheridan.
4. Kemmerer Coal Company, and Diamond Coal and Coke Co., Kemmerer.

These conferences, in all cases, have strengthened the vocational program and have been responsible for the support which local industry and community has given to the car program. Our last legislature gave us \$5,000 additional for the biennium. This makes the total contribution to our program \$50,000 from the state, and \$30,000 from the federal fund.

Status of Vocational Education in Canada

PROGRESS IN BRITISH COLUMBIA

John Kyle, Esq., Organizer of Technical Education,
Victoria, British Columbia, Canada
Day Schools

From the detailed statements contained in this report, it will be gathered that British Columbia continues to make slow-but-sure educational progress along technical lines.

A fine technical school has been built in Vancouver City, with workshops completely equipped for the following trades: Stationary engineering, electrical engineering, sheet-metal working, printing, automobile repairwork, cabinet-making, carpentry and joinery, plumbing, painting and decorating. The amalgamation of Vancouver City to South Vancouver and Point Grey has become an accomplished fact and from the increased area it may safely be predicted that the technical school will soon be overcrowded. It is fortunate that with over twenty acres of land in the school-grounds there is ample room for expansion.

A fine group of well-equipped junior high schools throughout the city will serve to feed the technical school with students who have been initiated into industrial work, therefore, the future of the Vancouver Technical School is bright and assured. Moreover, the Vancouver apprenticeship council is active and is taking advantage of the technical school for holding apprentice classes in carpentry and joinery, automobile mechanics, plumbing, sheet-metal working, and printing. Other trades are about to be added to the group.

There has also been erected at New Westminster a new technical high school, called the T. J. Trapp Technical School. In addition to the technical course there are three-year courses in commercial subjects and in home economics.

The School of Decorative and Applied Art in Vancouver provides day and night courses in the following: Drawing and design, applied design, modeling, lettering and illumination, figure drawing and composition, architecture, and pottery. The work accomplished is of a high order and the good taste developed will gradually permeate the productions of Vancouver. As the present accommodation is quite inadequate, a new school will be built before long.

High School Commercial Courses

Commercial courses are gradually increasing in the province and it has been, in the past, rather hard to recommend proficient instructors. However, the situation is perceptibly improving, and the teacher-training classes have been responsible for raising the standard of commercial teachers and of firmly establishing the commercial courses in many municipalities.

Associated with the school of commerce at King Edward High School, Vancouver, is a remarkable class in wireless. The equipment is of the best and the instruction given is outstanding. The graduates from this class may be found in all parts of the world.

The amount spent by the department as grants in aid of teachers' salaries from July 1, 1928, to June 30, 1929, amounted to \$64,704.70, and the grants in aid of buildings and equipment amounted to \$300,930.56.

Night Schools

Night schools were conducted in 69 cities, municipalities, and rural districts in the province. There was a total attendance of 7,629 individual students, but as a number of these students attended more than one class the total enrollment in all evening classes was 7,680.

The following subjects were included in the night-school courses: English, English for new Canadians, subjects for civil service examinations, subjects for pharmaceutical exam-

inations, subjects for junior matriculation, citizenship and economics, mathematics, mechanics, physics, machine construction and drawing, patternmaking, forging, machinists' work, steam engineering, automotive ignition system, magnetism, and electricity, electrical engineering, chemistry, metallurgy, coal mining, building construction, carpentry and joinery, architectural design, estimating, navigation, forestry, paper making, printing, commercial English, type-writing, stenography, accounting (elementary and advanced), commercial languages (i. e., Spanish, Russian, Japanese, Chinese, French), salesmanship, drawing and design, modeling, metal repousse, wood carving, embroidery, pottery, china painting, show-card writing, dressmaking, millinery, costume designing, laundering, breadmaking, canning, cookery, music (instrumental and choral), elocution and public speaking.

The total amount expended in grants in aid of teachers' salaries from July 1, 1928, to June 30, 1929 amounted to \$37,785.10.

Teacher-Training Classes

Technical Teachers. The training of technical teachers has been proceeding successfully for the past few years. The course includes one of 570 hours in pedagogics. The total training hours for a technical teacher amounts to 3,720, but this will be slightly adjusted during the coming year and we are confident that the course will ultimately be one of the best to be found in the Dominion.

Commercial Teachers. Training classes for teachers of commercial subjects have also proved to be extremely opportune and very successful. All candidates hold first-class teaching certificates of the province and some have university degrees. The certificates are of two kinds, assistant commercial teacher's certificate and commercial specialist's certificate.

Number of students enrolled in teacher-training course for commercial subjects 50
Number enrolled in the teacher-training course for technical subjects 28

The total amount expended in teacher training from July 1, 1928, to June 30, 1929, amounted to \$5,828.36.

Correspondence Instruction in Coal Mining and Surveying

This work is conducted to prepare men for the examinations demanded by the Department of Mines in the interest of public safety. The course embraces the following:

1. Preparatory mining course for boys over 15 years of age, who have left school.
2. Course in arithmetic and mathematics.
3. Course for fire boss, shift boss or shot-lighter's papers (third class).
4. Course for overman's papers (second class).
5. Course for mine-manager's papers.
6. Course in mine-survey work.

The enrollment in the mining courses number 221, and the lessons are so arranged that a boy on leaving school can continue his studies until he reaches the age of 23, at which age he is permitted to compete for his provincial mining papers. Course No. 1 is divided into 6 separate sections of carefully graded work, and regular application will fit a young man thoroughly for the examinations held for shot-lighters. With a continuance of his studies his papers as overman will not be difficult to obtain, and following these two the aspiring coal miner may rise to any height he desires.

When one considers that a young man, engaged in industrial work during the day, has the privilege of dividing his matriculation to university examinations into four sections and of trying one section each year, it will readily be seen

with what comparative ease a mine worker could step upward to work of an advanced character.

The total amount expended in correspondence instruction from July 1, 1928, to June 30, 1929, amounted to \$3,415.17.

Administration

The total amount spent on administration of technical work from July 1, 1928, to June 30, 1929, amounted to \$9,669.36, making a grand total of \$422,333.25 for the year:

Day schools	\$ 64,704.70
Night schools	37,785.10
Teacher training	5,828.36
Teaching by correspondence	3,415.17
Technical equipment	300,930.56
Administration	9,669.36
	<hr/>
	\$422,333.25

This amount was reduced by the grant from the Dominion Government of \$211,166.63.

INDUSTRIAL-ARTS AND VOCATIONAL TRAINING IN MANITOBA

**S. T. Newton, Esq., Director of Technical Education,
Winnipeg, Manitoba, Canada**

Industrial-arts work under the name of manual training was established in Manitoba in 1899 when four rooms were opened through the generosity of Sir William MacDonald, a Montreal philanthropist. This work has continued until the present time.



E. T. NEWTON, ESQ.
Director, Technical Education,
Winnipeg, Man., Canada

The training at first was confined to grades 5, 6, 7, and 8. In 1907 a royal commission was appointed to study the problem, and, as a result of the recommendations of the commission, two large technical high schools were built in Winnipeg in 1911 and well equipped with standard machinery so that they could be used for grown-ups.

Industrial-arts work has been carried on in these high schools continuously ever since for the day classes, and trade-extension work in evenings for young men and women engaged in the industries of the city.

The most popular of the evening courses are mathematics, industrial chemistry, painting, sign writing, show-card writing, die making, electricity, automobile work, carpentry, cabinetmaking, patternmaking, steel-square work, oxyacetylene and electric welding, machine shop, machine and architectural drafting, sheet metal, tool smithing, ornamental ironwork, auto mechanics, steam engineering, printing for men; and dressmaking, power sewing, millinery, cookery, fine arts, commercial art, and the various commercial subjects for women.

During the years following the Great War, industrial conditions were such that a very limited number of apprentices could be taken on in any of the industries, and little progress was made in developing vocational courses, except in commercial subjects, where there was a very large enrollment.

The outlook at present for vocational training is very promising, and an increasing number of boys are spending

half their time in the shops and the other half in related work on a preapprentice basis. An automobile trade school was opened in the city of Brandon in October. Suburbs of Winnipeg, like Norwood and St. James, have reestablished industrial-arts work and several of the larger towns intend to make a start at an early date.

The federal grant in aid of technical education has been extended for another five years, whereby half a million dollars of federal money along with an equal amount of provincial funds are now available but must be used within a five-year period.

In Winnipeg there are thirty industrial-arts teachers in the elementary and junior high schools and fourteen in the high schools. Shopwork is confined to grades 6 to 11. Sewing is provided for the girls in grades 6, 7, and 9, and a few of the high-school classes in grades 10 and 11. Grade 8 girls receive one-half day per week in cookery. All grades spend one-half day per week in the shops. It is a required subject in grades 6 to 9 and optional in grades 10 and 11.

In Winnipeg, 2,500 grade 6 boys receive industrial-arts instruction, 5,620 in the junior high school, and 980 in the senior high school. Approximately the same number of girls receive a half day per week of instruction in sewing, cooking, etc.

In grade 6 the classroom teacher teaches the sewing while the boys are at the shops. In all other grades specialists are employed.

The student hour cost for boys' shopwork is as follows: high school, 15 cents; junior high school, 11 cents; elementary school, 10 cents.

This cost does not include anything for buildings or equipment, but does include salaries of instructors, repairmen, caretakers, and all supplies.

The maximum salaries for industrial-arts teachers are as follows: elementary school, \$2,500 per annum; junior high school, \$2,700 per annum; high school, \$3,000 per annum.

Evening-school work is paid for extra at the rate of \$4 to \$5 per evening for a two-hour session.

Federal funds are not available for industrial-arts work but the annual grant from the province is the same for industrial-arts teachers as for other teachers. On all vocational work and on all commercial classes the grant is twice as large as for teachers of other work and is approximately \$575 per teacher.

For evening-school work and Canadianization classes, the government grant is \$2 per teacher for a two-hour session.

In order to reach citizens of the province living in isolated places, correspondence courses in vocational subjects is provided. Cooperative arrangements have been made with a number of the old-established and reliable correspondence schools, whereby, their instruction material and correction service is made available for these students. The government assumes more than half the cost of tuition in much the same way as it does a part of the cost of university and high-school residence instruction. So far, the plan is working out very satisfactory.

Similar correspondent courses are provided for high-school students. In certain courses a student may substitute a correspondence subject for a language or a science subject.

VOCATIONAL EDUCATION IN NEW BRUNSWICK

**W. K. Tibert, Esq., Director of Vocational Education,
Fredericton, New Brunswick, Canada**

The Province of New Brunswick passed the first vocational education act during the session of 1918. This act provided for instruction in commercial, homemaking, industrial-art, and technical subjects.

A beginning was made at the opening of the fall term in September, 1919, in Woodstock, where a full-time day school was opened, and during that winter, evening classes were organized in seven centers.

During the following ten years a slow but steady growth has taken place and today there are two vocational and six composite schools in operation in the province with a total day-school enrollment of 1,020 on June 30, 1929. Evening

students numbered 2,504. Sixty-two full-time day teachers and 99 evening teachers, are employed in these schools.

During the year 1928-29 no new work in vocational and technical education was undertaken, but there was some expansion in the schools already established, notably at Saint John and Edmundston.



W. K. TIBERT, ESQ.
Director Vocational Education,
Fredericton, N. B., Canada

A class in pulp and paper making was opened at Edmundston in November with an enrollment of 24. The students are all young men employed in the pulp and paper mills of Fraser's Limited, and classes have been arranged so that men may attend during their time off.

The total enrollment in day and evening classes shows an increase over the previous year. One encouraging fact is the ease with which our graduates secure employment. This speaks well for the future of our work, especially along industrial and commercial lines.

A summer school for home-economics teachers was held in the Saint John Vocational School during the month of July, and while the registration was not as large as in previous years, good work was done.

The summer school was under the supervision of Miss Rheta M. Inch, head of the home-economics department, at the vocational school of Saint John, N.B. She had as assistant Mrs. Florence M. Amidon, of the State Normal School, Framingham, Mass., Miss Grace M. Donelan, of Brookline, Mass., and Miss Helen M. Allan, of the State Normal School, Framingham, Mass.

Seventeen teachers attended institutions, other than that conducted by the vocational board, for further training. These included the University of Chicago, Bradley Polytechnic Institute, Peoria, Ill.; Royal College of Art, London, England; Columbia University, Harvard University, Cornell University, University of Toronto, University of New Brunswick, and Mount Allison University, Sackville, N.B.

The Provincial Board operated but one short course during the year. Classes were held in automotive electricity in Fredericton under the leadership of Mr. F. W. Gunter. It is hoped that during the coming winter this work may be expanded.

PROGRESS IN ONTARIO, CANADA

F. S. Rutherford, Esq., Director of Technical Education,
Toronto, Ontario, Canada

Legislation and Its Effect

Prior to the passing of the Vocational Education Act in 1921, the Ontario system of industrial and technical education was operating under the Industrial Education Act passed in 1911. This Act provided for instruction in industrial and technical subjects only. However, under the Act of 1911 a remarkable growth had taken place. From a beginning of one day school and eight evening schools in 1912, with a combined attendance of less than 4,000 pupils, the number of day schools increased to 13 and the evening schools to 51, with a combined attendance approximately

32,000 in 1921, employing over 1,000 teachers.

Under the stimulating influence of the Vocational Education Act of 1921, which marked an advance in vocational education by placing all forms of vocational instruction on the same basis and in the same panel for provincial grants, there was a further remarkable growth which brought the number of day schools in 1929 up to 45, not counting three navigation schools operating in the winter months, and the number of evening schools up to 61, with a combined attendance in excess of 59,000.

Great credit must be given to the municipalities which provided funds for the establishment and maintenance of technical education before the passage of the Act of 1921. The willingness to promote this type of education is indicated by the expenditures made by municipalities and by the province, as shown in the following table:

Year	Expenditures by Municipalities	Provincial Grants	Remarks
1913-4	111,117	56,235	
1914-5	123,091	54,611	
1915-6	171,989	58,192	
1916-7	229,147	65,024	
1918	493,199	110,637	
1919	659,072	140,294	
1920	1,347,905	511,021	
1921	1,585,086	670,758	
1922	1,871,614	638,217	
1923	3,957,136	624,558	
1924	3,105,235	672,077	
1925	3,365,434	743,427	
1926	3,499,380	813,581	
1927	3,929,177	849,564	
1928	6,159,560	878,627	

In 1919, The Dominion Technical Education Act was passed at Ottawa, and with the assurance of subsidies from the federal government the provincial scheme of grants was altered so as to provide liberal assistance to municipalities not only for maintenance, but also for expenditures on capital account. The new scheme came into operation in 1919-20, and its effect is shown in the sudden large increase in expenditure made in that year, and in succeeding years this was followed by a steady expansion which brought the annual expenditures of the municipalities close to \$3,500,000 in the year 1929 and the provincial grants over \$850,000 in 1928-29. The expenditures by the municipalities included costs of buildings intended to provide for academic as well as for vocational education.

Dominion Subsidies

In each year of the ten-year period (1919-1929) during which Dominion subsidies were available the expenditures by municipalities and by the province were more than sufficient to draw the sums allotted to the province by the Dominion Government. The initial amount available for the province was \$224,383.30, and this was increased until in 1923-24 the fixed annual sum of \$347,636.30 was reached. These annual sums amounted to \$3,178,608.97, and this total was received by the provincial treasury.

The provisions of The Federal Act and of The Provincial Vocational Act, together with the encouragement given by the provincial department of education, resulted in a province-wide development of some form of vocational education in all the cities and in several of the towns of the province.

Provincial Aid to Municipalities Increased

In the years preceding 1920 provincial regulations provided for grants on equipment approved by the Minister. These grants amounted to 100 per cent of the cost of the equipment and were paid in instalments as follows: during the first year 40 per cent of the cost, and 20 per cent in each of three succeeding years.

In 1921 the regulations were changed so as to provide for grants amounting to 50 per cent of the cost of approved equipment; 50 per cent of the costs of buildings, or portions of buildings and furniture, used exclusively for vocational instruction; and 25 per cent of the cost of those portions of composite buildings, such as assembly hall and gymnasium, used in common for vocational and academic instruction. In the unorganized portions of the province the grant provided for equipment, furniture, and buildings amounted to 75 per cent of the expenditures made by school boards in the districts.

Grants on salaries of the teaching staff were calculated as follows:

Seventy-five per cent of the expenditure on salaries up to and including an expenditure of \$2,000, and the following percentages on all expenditures on salaries above that amount;

Sixty-six and two thirds per cent of the expenditure above \$2,000 and up to and including \$5,000;

Fifty per cent of the expenditures above \$5,000 and up to and including \$10,000;

Thirty-three and one third per cent of the expenditures above \$10,000 and up to and including \$15,000;

Twenty-five per cent of such expenditures above \$15,000.

Assurance Given by Agreements

Agreements were entered into between the minister of education and representatives of the local school boards covering the expenditures on buildings, furniture, and equipment, under which the minister agreed to pay certain amounts annually, based on the expenditures actually made and audited. In practice this agreement set forth the total sum to be paid by the province and the annual payments of principal and interest on the debentures issued, which covered a period of twenty or thirty years. It is manifest, therefore, that the commitments of the province made while Dominion subsidies were available do not end when federal aid ceases, but will continue for a considerable number of years.

The following table gives the names and values of schools which benefited from both federal subsidies and provincial grants on account of capital expenditures on buildings and a list of schools erected recently which will receive benefit from provincial grants only:

Schools Which Benefited From Federal Subsidies and Provincial Grants	
Fort Williams	\$304,000
Galt	252,000
Guelph	215,000
Hamilton	766,000
Kitchener	270,000
London	318,000
Niagara Falls	203,000
Ottawa	115,000
Owen Sound	148,000
Renfrew	87,000
St. Catharines	\$232,000
St. Thomas	221,000
Sarnia	343,000
Sault Ste. Marie	253,000
Sudbury	255,000
Toronto (Riverdale)	788,000
Toronto (College of Art)	108,000
Weston	144,000
Windsor-Walkerville	794,000

Schools Which Will Benefit From Provincial Grants Only	
Beamsville	\$ 50,000
Belleville	286,000
Brantford	133,000
Chatham	130,000
Hamilton (Add'ns)	106,000
Haileybury	under consideration
Kingston	under consideration
North Bay	under consideration
Oshawa	215,000
Peterborough	\$ 261,000
Port Arthur	358,000
Ridgetown	57,000
Timmins	117,000
Toronto (Western)	1,100,000
Toronto (Jarvis)	170,000
Toronto (North)	under consideration
Welland	155,000

It may be said, therefore, that the federal subsidies aided considerably in financing expenditures on buildings, equipment, furniture, and in the payment of salaries of teachers. Under all the operative forces such a stimulus was given to the movement for technical education in the province that the scheme of grants established by the province is left unchanged and the burden formerly borne by Dominion and province is now borne solely by the province.

The Greatest Obstacle Overcome

The greatest obstacle to the extension and development of a broad scheme of technical education was the lack of suitable buildings and equipment. The federal and provincial subsidies enabled municipalities to provide accommodation and equipment, and under agreements these municipalities undertook to promote diligently the work of vocational education, to use the buildings and equipment to the fullest capacity, and to provide such management and teaching staff as the Minister would approve. The statistics included in this report on buildings, on teachers, and on enrollment show how fully advantage was taken of the assistance offered to remove all obstacles.

Statistical Information

The following tables show the progress of the vocational schools:

	DAY VOCATIONAL SCHOOLS				
	1920-21	1921-22	1922-23	1923-24	1924-25
Number of full-time teachers	191	212	286	371	416
Number of part-time teachers		60	51	88	108
Number of full-time pupils	2,600	5,344	6,987	9,184	11,595
Average attendance of full-time pupils	2,123	4,260	5,518	7,209	9,263
Number of part-time pupils	907	574	988	1,837	1,739
Aggregate student-hours of part-time pupils	40,996	37,776	60,972	177,638	237,378
Number of special pupils	1,019	1,604	1,427	1,798	1,875

	1925-26	1926-27	1927-28
Aggregate student-hours of special pupils	223,570	351,214	243,074
Number of full-time teachers	530	607	660
Number of part-time teachers	147	148	171
Number of full-time pupils	15,201	17,359	20,193
Average attendance of full-time pupils	11,689	13,400	15,480
Number of part-time pupils	2,743	2,729	2,878
Aggregate student-hours of part-time pupils	358,283	354,089	453,976
Number of special pupils	1,705	1,626	1,455
Aggregate student-hours of special pupils	173,365	166,928	186,477

EVENING VOCATIONAL SCHOOLS

	1920-21	1921-22	1922-23	1923-24
Number of teachers	909	1,075	1,097	1,193
Total number of pupils	27,297	32,545	33,581	36,452
Aggregate student-hours	1,119,287	1,176,039	1,298,746	1,413,302
	1924-25	1925-26	1926-27	1927-28
Number of teachers	1,182	1,196	1,225	1,276
Total number of pupils	35,764	35,226	37,977	39,096
Aggregate student-hours	1,503,248	1,477,785	1,569,940	1,706,855

Ontario Training College for Technical Teachers at Hamilton

A significant advance in shop instruction has been noted recently in many technical schools of the province. This is due, in part, to the fact that the teachers are gaining experience in the professional side of their work, but in greater part the advance is due to the training they received in the art and practice of teaching at the Ontario Training College for Technical Teachers at Hamilton. The improvement is shown in the general attitude of the teacher toward his work, in his organization of the subject matter into units and sequences, in the adaptation of the course to the level of the pupils' understanding, and in adjustment of the work to the rate of progress of the pupils. Attention is given to class instruction in addition to the individual instruction which is always prominent in shopwork. Improvement is therefore noted in time-saving devices, in organization of work, in class management, in procedure, and in the mechanics of teaching generally.

Matriculation Courses for Technical Schools

The University of Toronto in 1926 established a matriculation course for students in attendance at technical schools, who are candidates for admission to the first year in the faculty of applied science. One of the options offered is a specially prescribed course in arithmetic, and certificates in mechanical drawing and shopwork are accepted from the principal of the school when accompanied by an approved certificate from the provincial director of technical education. This option is accepted in place of a language.

In the year 1927 household economics, as taught in the technical schools, was recognized as an optional subject for admission to the course leading to the degree of bachelor of household science.

Credits are given at the Ontario Agricultural College for work done in the vocational-agricultural schools and at Queen's University for work done at the mining schools. When work done at the commercial schools is similarly recognized, no door will remain closed upon vocational-school students.

Summary

The past ten-year period has seen the rapid rise of new vocational schools with a very general distribution in the province, covering instructional work for industry, for agriculture, for mining, for the home, and for business and commerce. Vocational instruction is no longer looked upon as a supplement to another form of education, but is regarded as a complete preparatory unit in itself, and has rapidly gained the approval of the communities where such schools have been established.

TECHNICAL EDUCATION IN QUEBEC

Augustin Frigon, Esq., Director General of Technical Education, Province of Quebec, Canada

The first serious attempt to do anything in the educational line for the fine arts and industry was in 1872, when the Council of Arts and Manufacturers was founded by an act of the Quebec Parliament. It must be mentioned in passing, however, that a number of very important art and trade schools flourished during the "French Régime" as far back even as the end of the seventeenth century, but disappeared after the conquest. Nothing further was attempted along these lines until Confederation. Day and evening classes were maintained by the Council of Arts and Manufacturers until last year, when their activities were

absorbed, part by the provincial technical schools and part by the fine-arts schools at Quebec and Montreal.

The Council of Arts and Manufacturers had classes in fifteen different centers with a total enrollment of about 5,000 students. The principal subjects taught were: Mechanical drawing, architectural drawing, free-hand drawing and painting, carpentry, plumbing, sign painting, solfeggio, millinery, dressmaking and sewing, etc. For a number of years past, quite a number of classes in home economics have been given by various school boards and by religious organizations engaged in teaching. A certain amount of manual training has also been done in the primary schools, particularly in Montreal.



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Director General Technical Education,
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It must not be forgotten that primary education in the Province of Quebec is under the control of the department of education, which has two divisions, viz., the Catholic Committee and the Protestant Committee. These two committees have absolutely equal rights. They control all the public schools in the Province, which are on that account divided into two groups: the Roman Catholic schools and the Protestant schools. Taxpayers are obliged to support either one or the other of these two groups. The department of education, in turn, comes under the Provincial Secretary's Department, although the minister in charge of the department does not possess the authority which is usually invested in a minister of education.

There are, furthermore, numerous religious orders engaged in teaching, which as far as administration is concerned, are responsible only to their own local school board. The authority of the department of education being limited to a predetermined program, there is no central control of all education in the Province, and, although the Provincial Department of statistics succeeds in obtaining general data on attendance, etc., it is practically impossible to secure an accurate idea as to just what special courses (and their importance) are given in home economics in numerous schools conducted by the Nuns on which very little data is available. These courses and many others do excellent work, which, on account of their limited field of action, cannot be properly appreciated. These explanations, I believe, are necessary, in order to demonstrate how difficult it is, in an article like this, to describe the nature and full extent of the work done in this province in the field of fine arts and industrial education.

Besides the work done by the various school boards, certain special schools may be organized, according to the terms of a by-law, which was passed by the Provincial Government in 1926. This law supersedes similar by-laws which have been adopted in the past.

The schools, which come under the terms of the above by-law, are: Montreal Technical School, Quebec Technical School, Hull Technical School, School of Higher Commercial Studies, Fine Arts School in Montreal, and the Fine Arts School in Quebec. These schools are by far the

most important in the Province. The first three offer a number of different courses: the regular three-year day technical course; the two year day trade school course; a part-time day cooperative apprenticeship course in printing at the Montreal Technical School (to which other similar courses will be added in the near future in both Quebec and Montreal); a short-term special course for auto mechanics; and a large number of evening classes. A very important feature of these schools is that they are bilingual, every student having the choice of following his course in either English or French. These schools enroll only boys and young men, the enrollment during the season 1928-29 being as follows:

	Day Classes	Night Classes	Total
Montreal Technical School.....	724	1,429	2,153
Quebec Technical School.....	238	554	792
Hull Technical School.....	90	258	348
Total			3,293

The equipment at these schools is absolutely up-to-date. The Montreal school in particular can boast of possessing shops, which are second to none on the whole continent of America. Special mention should be made concerning the three-year day technical course, which is designed to give the student a good all-round general training, and, in addition, permits him to specialize, in his last two years, in either the mechanical, electrical, or building-construction departments. The graduates of this regular day technical course are in great demand, indeed, so many requests have been received for these men that for the past few years back, we have been able to supply only one third of the demand. Negotiations are still being carried on with regard to the establishment of apprenticeship courses in the building trades, to operate in full cooperation with both employers and employees. It is expected that these courses will be organized in the near future.

The School for Higher Commercial Studies offers day, evening, and correspondence courses. The more advanced day classes are of university grade and admits one to a license in accounting. The various evening classes in commerce, finance, and foreign languages are well attended by a large number of students. The correspondence courses, which were organized only four years ago, are becoming more popular every day and seem to be greatly appreciated. The enrollment statistics for the session 1928-29 are as follows: day classes, 162; evening classes, 416; making a total of 578.

The schools of fine arts at Montreal and Quebec, with their special departments devoted to architecture, have proved very popular, so much so, indeed, that about only one half of those seeking admission can be accepted. This selection is based on an entrance examination which all candidates must pass. It is very gratifying to notice the support the public is giving these two schools, and, anyone visiting the annual exhibit of the work done by the pupils will realize that this support is well deserved. Special mention should be made of the work done in the decorative art section. The attendance at these two schools during the session 1928-29 was as follows:

	Day Classes	Evening Classes	Total
Montreal School of Fine Arts.....	671	223	894
Quebec School of Fine Arts.....	469	none	469
Total			1,363

In addition to these six provincial schools, which are directly administered by the Provincial Secretary, another school, located at Three-Rivers, Quebec, and under the control of the Minister of Lands and Forests, is conducted along lines similar to the other technical schools. A special feature of the Three-Rivers School, however, is, that it offers a special course in the pulp and paper industry to employees of the mills located in that district.

The Province also subsidizes a certain number of technical schools and special courses in various localities, the most important of which is the Shawinigan Technical Institute, founded by Mr. Alfred, president of the Shawinigan Water and Power Company, and administered by a board composed of representatives from the different industries in Shawinigan Falls. This school, which offers both day and evening classes, is very well attended. It also looks after the manual-training classes in the primary schools at

Shawinigan. The enrollment for the scholastic year 1928-29 was as follows: day classes, 155; evening classes, 200; total, 355.

The Montreal Technical Institute, also subsidized by the Province of Quebec, but administered by a governing body of seven governors, appointed, one by the Provincial Government, one by the Montreal Board of Trade, one by the Protestant Board of School Commissioners, one by the Mechanics Institute and one by the Montreal Branch of the Canadian Manufacturers Association, these five naming two others, offers only evening classes in certain subjects. It has done excellent work for a number of years. Attendance for the year 1928-29 in the evening classes was 725.

Smaller schools, which however are doing excellent work, are to be found in various localities such as Grand'Mère, La Tuque, and Chicoutimi. In these schools students, who have completed the seventh grade, have the option of selecting either a two- or three-year course, one commercial and the other a trade-school course. The trade-school courses have been more or less patterned after those in the provincial schools. Although the enrollment in these courses is not very large, these schools, nevertheless, fill a great need by supplying local industries with a number of well-trained young men. Similar courses will be organized in other districts very soon.

Some of the above schools receive subsidies from the local civic government, such being the case with regard to the Montreal, Quebec, and Hull technical schools.

All technical education, in the strict sense of the term, that is to say, all schools with the exception of the Schools for Higher Commercial Studies and the two fine arts schools at Quebec and Montreal, come under the immediate control of the Provincial Director General of Technical Education, who is in turn responsible for the administration and direction of this work to the provincial secretary, at present, the Honorable Athanase David, who is a member of the Provincial Administrative Council.

The policy of the Provincial Government with regard to special schools, such as the technical schools, is to offer the best possible course in all subjects. In other words, quality rather than quantity, is the object sought. For this reason, it has never aimed at enrolling the largest number of students possible, but has strictly limited the attendance to those who are properly qualified to follow the various courses offered. This policy seems to have met with the approval of all concerned. As a matter of fact, the popularity of technical education in Quebec Province, has increased enormously during the past few years, and one can visualize the future of technical education with the greatest optimism.

The Part-Time Schools of Wisconsin in 1929

Geo. P. Hambrecht, Director, Wisconsin State
Board of Vocational Education

The Wisconsin part-time schools now operating in 42 Wisconsin cities, each year maintain educational contact with 35,000 young working people between 14 and 18 years of age in the daytime, and with over 40,000 adult workers in evening classes.

Educational Value of Work

The steady development and improvement of the system of part-time schooling in Wisconsin, over the past twenty-year period, is due, in large measure, to the recognition of the fact that labor and education may be satisfactorily combined. Work has educational value. Anyone who learns to do a piece of work well, and then goes on to more difficult tasks, is acquiring an education. To learn to conquer difficulties; to acquire and develop greater skill; to meet, understand and get along with people, are all phases of educational experience.

While work itself offers certain kinds of educational values, which can be obtained nowhere else, there are many who never learn to take advantage of these values. In all our talk of work as an educational factor, we are prone to forget that work by itself will not take us far unless something or somebody urges us on to the next step. The educational value of work depends, to a greater extent than most people realize, upon the presence of capable associates with helpful personalities. Very few of us go far, even in our work, without the help of someone with whom we are associated—some leader with a radiating personality, who takes an interest in us, has faith in us, encourages us, helps us over rough places, points the way ahead. It may be a parent, it may be a fellow worker, it may be a school teacher.

Work and School

The establishment of the part-time school is an attempt to provide an opportunity for every working youth to come into contact with men and women interested in his welfare

and capable of giving him inspiration and practical instruction. Until the part-time school was established, we had the unfortunate condition in which one group of young people was getting all the working experience and another all the schooling. To avoid a one-sided training, each group needed something that the other was getting. Those in school were missing the work experience; those working lost out on the school experience which might help them to appreciate and get the most out of their work.

As an educational agent, labor by itself is not a substitute for schooling; nor is schooling a substitute for labor.

Common Problems of Employers and Employees

After careful investigation and study the legislature of 1911 provided, under the same administration, for the establishment of part-time schools for young workers and of evening schools for adult workers. Realizing that the part-time schools, in order to be successful, must have the close cooperation of employers and of adult labor, the legislature insured this cooperation by making these two groups parties to the actual administration of these schools, and responsible for their development. Years before, when the university and the normal schools were established, they were each provided with a separate board of regents for their respective administrations, in order to serve properly the respective groups of students affected, numbering in the aggregate some 15,000 resident pupils. Over 75,000 resident workers,

juvenile and adult, are reached by the Wisconsin part-time schools. To take care of this important group problem, affecting so many people throughout the state, a special *Board of Regents* for the workers was created and designated *The State Board of Vocational Education*. This is a representative board, consisting of three employers, three employees, and three farmers, appointed by the governor, a member of the state industrial commis-



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sion, and the state superintendent of public instruction. The state superintendent, as a member of the board of university regents, of the board of normal-school regents, and of the state board of vocational education, provides the unifying and coordinating influence for the entire Wisconsin school system, part time and full time.

Local Boards of Vocational Education

Local boards of vocational education were established to administer the schools in the various cities, through the local director whom they appoint. Each of these local boards of vocational education consists of five members—two representatives of local employers, two representatives of local employees, and the city superintendent of schools. The members of the local boards of vocational education are appointed by the local school board which administers the full-time schools. The local school board selects two leaders each of the employer and employee groups who can represent adequately the point of view of the employer and of the employee. The city superintendent of schools is ex-officio a member. The statutes provide for full and complete cooperation between the state and local boards of vocational education to carry out the state's program for part-time school contact for juvenile and adult workers.

The success of the part-time school movement in this state has been due, largely, to the fact that employers and labor are cooperating with the state and local boards of vocational education to make these schools valuable.

Itinerant Instruction in Trade and Industry

One of the outstanding developments in vocational education in Wisconsin in the past few years, is the rapid growth of the itinerant teacher system in trade and industrial occupations.

The itinerant instructor is usually employed by four neighboring cities and regularly spends one day a week with his industry in that city. Part of the day is spent in each. Part of the day in each city is given to making contacts with his industry in that city. Part of the day is spent in the part-time school giving instruction to apprentices and day part-time-school pupils in the community. The evening is usually devoted to a trade-extension class for the adult workers in that industry.

There are now three circuits in electricity. One itinerant instructor serves the communities of Watertown, Janesville, Fond du Lac, and Beloit; another, West Allis, Cudahy, South Milwaukee, and Waukesha; and a third, Wisconsin Rapids, Stevens Point, and Marshfield. There are three circuits in painting and decorating. Madison, Watertown, Janesville, Beloit, and Racine form one circuit; Green Bay, Manitowoc, Oshkosh, and Fond du Lac form another; West Allis, Cudahy, South Milwaukee, and Waukesha make up the third. There are four circuits in plumbing. Green Bay, Appleton, Oshkosh, and Fond du Lac; Manitowoc, Sheboygan, Racine, and Two Rivers; West Allis, Cudahy, South Milwaukee, and Waukesha; and Madison, Janesville, Beloit, and Watertown. One circuit of instruction for those in the pulp and paper industries consists of Rhineland, Wausau, Mosinee, Wisconsin Rapids, and Eau Claire; another consists of Neenah, Green Bay, and Marinette. In the other paper-making cities, such as Marinette, Kaukauna, and Stevens Point, classes are organized by the joint coordinator in charge of trade-extension activities in 21 cities, and men in the local industries are employed as part-time instructors.

There is an itinerant instructor in foremanship training, who organizes and conducts classes throughout the state. The itinerant instructor in safety is an employee of the Wisconsin Industrial Commission.

The state board of vocational education has promoted the itinerant plan. It has assisted the vocational boards in the local communities in organizing themselves into convenient circuits, and in organizing, developing, and presenting a comprehensive list of courses.

Adult Trade Extension

Twenty-one vocational-school cities have joined this year in employing a coordinator to develop and organize trade-extension courses for the adults of their respective communities. The joint coordinator employed has had

years of experience in paper-making education in Maine and in Wisconsin, and last year, as coordinator for the paper-making cities of Wisconsin, organized classes in pulp and paper making throughout the state.

Teacher Training for Adult Trade Extension

For the classes organized in adult trade-extension work, part-time instructors taken from the trades in the various communities have been employed. These instructors are meeting in groups to study teaching methods with the supervisor of teacher training for the state board of vocational education.

Homemaking Instruction for Girls

The 10,000 girls in the homemaking courses in the part-time day school fall into four groups: those who have entire charge of homemaking in their fathers' homes; those who are staying at home helping their mothers; those who are employed in domestic service; and those who are working in industries outside the home. As high as 50 per cent of the girls enrolled in some schools are actual homemakers, taking the place of mothers to little brothers and sisters, and housekeepers for fathers. To meet these varied needs, the schools must offer instruction which will improve the girls' health and personal appearance, training in courtesy, choice and care of clothing, physical education, and definite courses such as children's clothing, underwear, home dressmaking, home millinery, laundry, house planning, infant care, home nursing, first aid and safety, textile fabrics and purchasing, repair of clothing, thrift, meal planning, preparation and serving, house planning and decorating, and nutrition.

Home Economics

During the spring of 1929, two-day working conferences were called in four different sections of the state, for the purpose of selecting, organizing, and discussing the related art and related science to be taught to part-time pupils in the homemaking classes of the Wisconsin vocational schools. Sixty homemaking teachers attended these meetings. Committees were formed to develop outlines and lessons plans. The results of their work will be distributed to the homemaking teachers of the part-time schools for tryouts. The teachers who try out these outlines will make criticisms and suggestions for their improvement. The next step will then be a reorganization of this teaching material.

Training for Homemakers in Rural Communities

The Wisconsin State Board of Vocational Education is promoting the giving of short-unit courses for girls and women in rural communities. Classes have been organized in seven rural communities under the George-Reed Act and in one community under the Smith-Hughes Act. The teacher in each case is attached to some school. The schools which now serve as centers of this work are the consolidated schools at Sevastopol, near Sturgeon Bay, in Door county; the consolidated school at Ondassagon, near Ashland; the free high schools at Frederic, Fennimore, Omro, and Waupaca; the County Agricultural School of Wood county, located at Wisconsin Rapids; and the part-time vocational school at Stoughton. The teachers are employed on a twelve-months' basis. They have automobiles and go out over a ten- or twelve-mile radius to do promotional work and to visit the homes of their pupils and supervise home practice. For those who are near enough to attend, they give courses in their schools at hours convenient for girls and for adult homemakers. For those who are too far away to come to school, they organize classes at convenient places. In one community the teacher has already organized five adult homemaking classes.

Among the courses suggested for choice by the various groups are home nursing, child care and training, nutrition, meal planning, baking, invalid cookery, entertaining, home management, home furnishing, interior decoration, laundry problems, garment making, renovation of clothing, dressing well on a limited income, budgets and accounts, personal improvement, and first aid.

The teachers were given special training for their work in the summer-session class conducted at the University of Wisconsin by the supervisor of home economics of the state board of vocational education.

General Education in the Vocational Schools

The work in such general subjects as English, social science, and general science is improving greatly as the schools are being brought into buildings in which the teachers can have permanent quarters and begin to provide themselves with material suitable for quick, effective work. An important feature of all the new buildings is the library, which is a sort of laboratory for the teaching of English. Through short courses in the literature of occupations, biography, Wisconsin writers, midwestern writers, western, southern, eastern and northern writers, what to read, magazines, newspapers, and other courses introducing pupils to a wide variety of reading material, every pupil is finding something of interest and value and is being directed toward the public library as a source of future pleasure and profit.

Evening Schools in Wisconsin

The improvement in the day schools is matched by the improvement in the evening schools. The people are demanding and receiving a better quality of evening-school work than ever before. At one time, the most popular courses were those in which articles of all sorts were made to take home. Now people are coming term after term for training in fundamentals. The commercial work given in the evening includes complete courses like those given in the daytime: accounting, advertising, bookkeeping, business correspondence, business English, the use of calculating machines, the use of the dictaphone, dictation, filing, penmanship, salesmanship, shorthand, typewriting, and commercial law.

Homemakers no longer come for sewing and cooking alone, but for child care and training, special diets, meal planning and nutrition, home management, home decoration, home nursing, plain sewing, cutting and fitting, remodeling, children's clothing, and clothing selection. Last year more than 10,000 women and girls, over 18 years, received instruction in the home-economics courses in the vocational evening schools of Wisconsin. The courses were made up of short progressive units dealing with different phases of homemaking. The women interested are thus given a chance to enroll for intensive training for a short period, with the opportunity to progress to another short unit when that one is completed.

The evening trade and industrial work is practical and varied. In 1929, as in 1928, training was given in more than forty lines of work in the various schools of the state, including architectural drawing, auto mechanics, auto and gas engineering, barbering, blue-print reading, bricklaying, cabinetmaking, carpentry, drafting, electricity, garment designing, machine shop, meat cutting, meat-market management, mechanical drawing, mechanics of materials, applied mechanics I and II, painting and decorating, pharmacy, plumbing, roof framing, sheet-metal drafting, shoe repairing, slide rule and shop mathematics, shop sketching, steam engines, strength of materials, upholstery, watch repairing, and welding.

In one school, electricity included courses in armature winding, auto electricity, beginning and advanced a.c. and d.c. electricity, electric furnace, electrical design, electrical machinery, and electrical theory I and II. In the same school, printing included courses in advanced hand composition, linotype operation, presswork, and courses of the United Typothetae of America and the International Typographical Union.

The general courses have also undergone a great change. Whereas, once there was little help for anyone except a person of foreign birth seeking to learn English or take out his citizenship papers, there is now in many of our cities a broad and varied program for men and women seeking an elementary, secondary, or even higher form of general education. The classes for those learning to speak and read English still exist, but beyond that are classes in literature, composition, public speaking, and grammar. Foreign languages are popular: French, German, Spanish, Italian, and Esperanto. Social science is represented by classes in economics, American politics, municipal problems, Wisconsin history, and international relations.

Agricultural Education for Youth and Adults

The training of farm boys in high school and those who for various reasons have left high school, is the aim of departments of vocational agriculture. There are in 1929-30 over three thousand boys enrolled in four-year departments of vocational agriculture in 88 rural high schools of the state, and there will be in addition approximately two thousand farmers and farm boys enrolled in part-time and evening classes. There are four-year courses offered in the high schools, consisting in most cases of a year of plant husbandry, a year of animal husbandry, a year of farm mechanics, and a year of farm economics. In the part-time and evening classes short-unit courses are offered which are of particular interest to specific groups.

An interesting feature of this year's work is the development in the vocational school at Stoughton, of the department giving part-time and evening courses for farmers and farm boys out of school. This is believed to be the only department in the United States where a man is giving full time in one community to this phase of work. Meetings are being held once a week in each of a half dozen rural schools around Stoughton.

Practically all of the instructors in vocational agriculture in the state will conduct at least one short-unit course—either a part-time course for farm boys or an evening school for farmers, in addition to their regular high-school departmental work this winter.

Supervised practice work is a most essential feature of vocational agriculture in all high-school departments of vocational agriculture as well as in part-time and evening schools. Every pupil enrolled carries on some form of approved practice as a result of the instruction in the school. This practice in most cases consists of the introduction of better crops or better breeds of livestock, the improvement of soil-management practices, and the keeping of herd and farm records. The agricultural teacher maintains close contact with all of his pupils by frequent visits to their home farms throughout the year. During the past two years, project-study conferences have been held with groups of the agricultural teachers throughout the state during the summer so that every instructor in the state has had the opportunity to study the supervised practice work conducted by some other teacher.

Sixty-seven per cent of the farm boys enrolled in high schools in which there are departments of vocational agriculture are this year studying vocational agriculture in these schools. The average enrollment of farm boys in departments of vocational agriculture is 27.4. With seven new high-school departments this year, there are 252 more farm boys enrolled than in 1928-29.

Rehabilitation of the Handicapped

With most of our work in education, it is impossible ever to get an accurate measure of the results. There is one phase of our work, however, on the actual and immediate economic results of which we do have definite information. This is the training of those who are physically handicapped to earn their own living. Taking the records of 1,391 disabled persons rehabilitated in the past seven years, we find that their annual earnings averaged \$435.84 before rehabilitation and \$1,135.81 afterwards. This annual per-capita increase of \$699.97 in earning power was secured at a total cost to the state and federal governments of \$251.75 for each case. This is only the tangible economic gain. The intangible value to the individual cannot be calculated.

There is no limit to the service which the day part-time and the evening schools may render to a community which really wants educational opportunities. The 75,000 citizens whom the part-time and evening schools of the city and rural districts served in the past year, are a small number compared with the thousands of others who really want what these schools could give them, but who have never found the way to make the desired educational contact. As these awaken to their opportunities, the part-time and evening schools will become more and more important as factors in the development of the whole community. Every dollar wisely invested in furnishing these contacts will bring back to society a wealth return, both social and economic, commensurate with the breadth and intensity of the educational programs projected.

Industrial-Arts and Vocational-Education Activities in Various Cities

Industrial-Arts Activities in a City of 18,000

Wayne E. Steiner, Director of Industrial Arts, Sunbury, Pennsylvania

Seven years ago the public schools of Sunbury, Pennsylvania, took the initial step to establish a definite program of industrial-arts activities. Bearing in mind that the strength of any structure depends in large measure on the strength of its foundation, we decided to build a foundation wide enough and anchor it deep enough that it would be able to support any structure we might choose to erect thereon.

Bearing in mind also that the economic progress of any nation or the world in general does not depend on one trade alone, but on many different trades, we decided that our program of industrial-arts activities should not be based on one or two trades, but rather on the trades that are fundamental to our economic progress.

Thus we are able to give the boy a foundation or general knowledge of many different trades or activities which will give him the ability in later years to choose a trade and prepare for his life's work.

In order to get our educational foundation well grounded, we arranged our program of activities to begin with the first grade and continue through all the grades until the boy would be able to go out into the industrial world and get trade experience and knowledge by direct industrial contact.

First Grade. The industrial-arts activities of the first grade are carried on in the first-grade classroom under the direction and supervision of the first-grade teachers. The activities consist of drawing and construction work, free-hand drawing of trees, fruit, houses, flowers, bowls, boats, hatchets, pumpkins, fences, hearts, furniture, and animals.

The construction work consists of projects that can be constructed from paper with the use of scissors and paste. Boxes with lids, sleds, baskets, and kites are some of the projects used.

Time devoted to this work: 15 to 20 minutes a week.

Second Grade. The work in the second grade is similar to the first-grade work. The projects are more difficult, involving combinations of drawing and paper cutting and color work. For Halloween, cats, witches, half-moons, bats, etc.

Turkey gobblers for Thanksgiving and umbrellas for the rainy days are constructed from paper.

Other projects involve girls drinking a glass of milk, match boxes with a Christmas tree design, Christmas trees, Santa Claus, eskimos, igloos, icebergs, dogs, reindeer, etc.

May baskets with paper flowers, Easter lilies, rabbits, eggs, and bluebirds.

Time: same as in the first grade.

Third Grade. In the third grade, certain definite activities are arranged for each month of the school year. In September, cut-outs of leaves and trees, baskets with fruits, apples, pears, plums, and grapes, are made. In October, cats, bats, owls, false faces, toothbrushes, bathtubs, soap, milk bottles, and a jointed corn man, are among the cut-outs. In November, turkeys, pilgrims dolls, log cabins, canoes, and Indians are cut out. The December list embraces pine trees, fireplaces, sleds, bells, shepherd and sheep, poinsettia, jointed Santa Claus, and candy boxes. In January, toy booklets, containing cut-outs of drums, trumpets, sleds, balls, seals, snow men, caps and mittens, are made. In February, cherries and leaves, hatchets, silhouettes of Washington and Lincoln are the articles to be cut out. In March, windmills, kites, geese, paper hats, houses, and hat boxes are made. The April list contains birds, bowls and flowers, umbrellas, garden tools, and paper clocks. In May, jointed clowns, circus wagons, circus animals, cages, the numbers from 1 to 9, and the letters of the alphabet are cut out.

Fourth Grade. The work in the fourth grade is similar to the third-grade work, depending upon the individual teacher so far as projects are concerned.

Time: Same as in the second and third grades.

Fifth Grade. The work in the fifth grade is a continuation of the work in the fourth, with the addition of projects made of wood. Simple book ends are constructed, using the coping saw and knife. These book ends are finished with paint or stain, and shellac. Jars and bottles are painted and enameled. In all of this work the children are given an opportunity to express their individuality.

Time: Not more than 25 minutes a week.

Sixth Grade. Continuation of work in the fifth grade involving book ends, doorstops, window wedges, toothbrush holders, etc.

Soap sculpture is introduced, and squirrels, rabbits, cats, elephants, etc., are carved in ivory soap.

Linoleum block printing, poster work, glass painting, also are introduced and booklets on "Our Home," "Spring Styles," "Bird Booklets," and "Winter Sports" are studied.

Seventh Grade. Beginning with the seventh grade the boys are given a definite period in each activity of the general shop.

Three instructors have charge of a group of 72 boys at one time, which are spread out in groups of 12 working in the different activities of the shop. Experience has taught us that there is no difference in the ability of a boy in either the seventh or eighth grades, so we place them in the several activities without regarding the grade they may be in.

Drawing is not taught as a separate subject, but in connection with the activities in each unit with the exception of the foundry and printing. After a boy has completed his seventh and eighth year at school, he will have had instruction and actual work in all the units of the general shop and should he desire to continue shopwork, he is now at liberty to select a unit of work and continue the work which he started in the seventh or eighth grades. The time allotted to shopwork in this grade is one full day each week.

Dr. Walter A. Geesey, superintendent of schools, Sunbury, Pa., who is a firm believer in industrial education and especially of the general shop has formulated the following definition of a general shop:

"The general shop is a semivocational plant embracing two or more units of work and presided

over by one or more instructors. Its purpose is to acquaint the student with the tools, technique, and aims of those trades that are fundamental to our economic progress, and to teach him the interdependence of the human race.

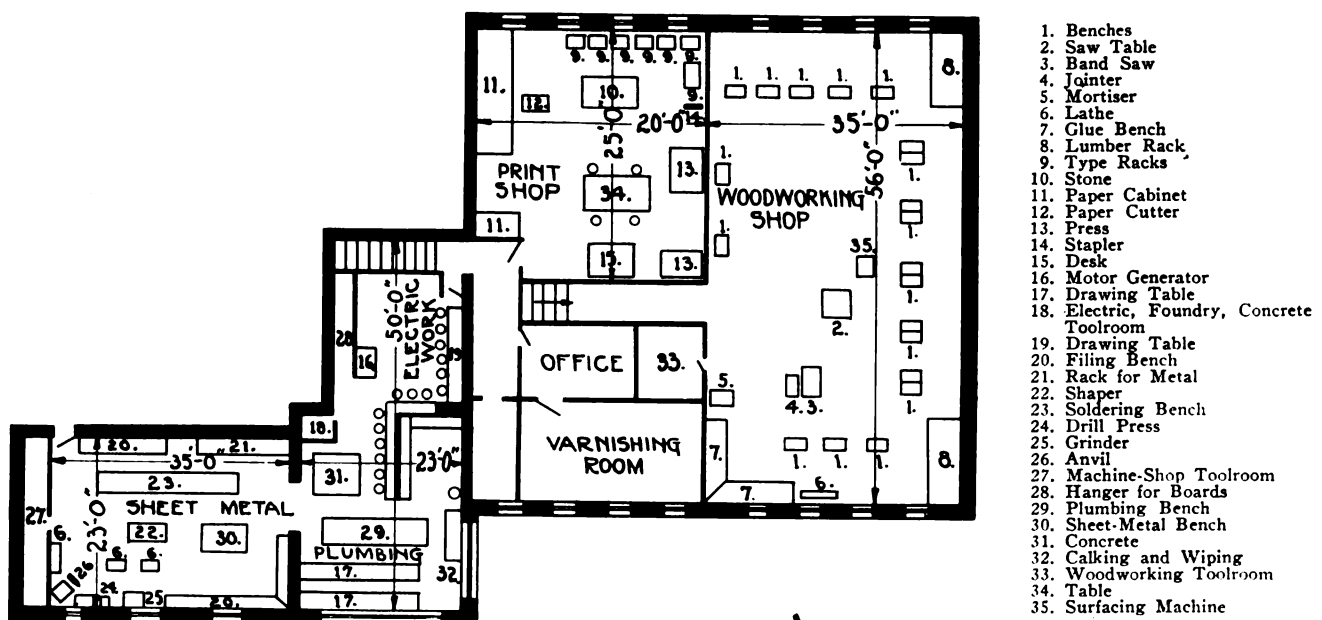
"Its scope is prevocational—the teaching of trades is not its aim. It is content with grounding pupils in the fundamentals of, and showing the relations between, the various occupations.

"This shop provides for the likes and dislikes of the student, his tastes and distastes, and his aptitudes and inclinations, by providing a period of orientation, preceding the selection of a constant unit."

Foundry Work

Every boy in the seventh and eighth grade is given a period of six weeks in foundry work. The aim in this unit is to acquaint the boy with the source of cast metal used in the manufacture of present-day machinery. One period, 90 minutes in length, each week is allowed for this work. This may seem as a short time to acquaint boys with this work, but by experience we find that the boys will do a lot of work in this time.

During the first week in this activity he is taught the terms that are used in the foundry, such as flask, sprue, gate, etc. We do not teach definitions but give each boy a sheet with each term defined. The boy is instructed to read these definitions carefully and intelligently and to report when he is familiar with them. Usually they report in a very short time, and their knowledge is tested, not by asking them to define the terms, but they are asked to get a flask, or a sprue pin, or some other piece of foundry equipment.



GENERAL SHOP, SUNBURY, PA.



EXAMPLES OF FOUNDRY WORK

If the boys have not read the sheet intelligently, they are permitted to refer to the sheets a second time. In a short time, every boy is able to call the foundry equipment by the correct names.

The first job is ramming up a mold from a pattern having a heavy draft. Then one-piece patterns of geometrical solids, such as cubes, pyramids, cones, prisms, are cast. The student is then ready to do more artistic work and he may select a pair of book ends, a doorstop, or paper weight. The boys like to make castings of these objects, and there are very few that do not attain sufficient proficiency to make them in their tryout period. Only soft metal, such as lead, babbitt, and alloys made of old lead pipe, babbitt bearings, etc., are used for this foundry work.

The boys who select foundry work as a permanent unit in the ninth grade, make castings of aluminum or aluminum alloys. They also make use of more difficult split patterns, cores, etc., in their work. They also make machine castings that are afterwards used in the machine shop in the construction of machines which are suitable for the boy's home workshop.

The foundry boys are taken on a tour to some foundries, so that they may become acquainted with industrial molding practices, and see how gray iron castings are poured.

Equipment for a 6-Boy Foundry Section

The cost of equipment for a foundry unit is very little in comparison to the results that may be attained. The following list shows the equipment which we use in our foundry. The approximate cost is also given.

3 No. 8 Riddles @ \$1.20.....	\$3.60
2 Pair bellows @ \$1.75.....	3.50
3 Draw screws .....	.15
3 Draw pins .....	.15
1 Swab .....	.50
1 Square molder's shovel.....	1.75
6 Fire shovels	1.25
2 Molder's clamps .....	.80
6 Flasks, 9 by 12 in. with bottom boards, and molding boards	2.40
2 Molder's trowels	2.50
1 Spoon and slick	1.50
2 Barrels No. 6 brass sand.....	4.50
1 Melting furnace	32.50
1 6-in. ladle .....	.90
1 3-in. skimmer .....	.20

The draw screws, pins, flasks, molding and bottom boards, were made in our own shop.

Concrete Unit

The work in concrete has been added very recently and is still in the experimental stage. Forms are constructed to make simple concrete bricks, tiles, etc. These are followed by molds requiring a greater degree of skill. Terms used in concrete work are explained and different formulas are tried out and studied in connection with the different materials. Flower boxes are made, using commercial molds, and jardinières and urns are made by using metal lath and the plaster method of construction. The object in this course is to impress the great possibilities and the great varieties of work possible in concrete and cement construction.

Printing Unit

One period of 90 minutes per week, for twelve weeks, is spent in the printshop by every boy while he is in either the seventh or eighth grade. During the first period, some time is given to the history of printing, and to the methods used by different races and tribes of the ancient world in the recording of events. The history of the invention of movable type is then taken up, and this is followed by a study of the lay of the case. The boys are shown that the letters used more frequently are placed near the center of the case, and that they also receive the larger divisions of the case. The letter e, for instance, being used more frequently than any other letter, occupies the position near the center of the case, and has the largest division.

The study of the case is begun by using the letters e, i, s, a, r. After these can be located readily, the composing stick is introduced, and a number of words containing the five aforesaid letters, are set up. After completing this exercise in composition, a proof is taken, the necessary corrections made, and then a few copies of each boy's work are printed on a foot-power press.

After completing this work satisfactorily, the letters o, h, m, n, c, are added, and after being able to locate these, sentences using only the ten letters mentioned in the foregoing are set up. By using this method, the boys do not become discouraged

and tired of studying the lay of the case. After the entire case is studied, the boys write up small articles which are corrected and approved by their English teachers. Each boy then sets up the article which he has written to regular newspaper column width, and after the proof is taken by him and all mistakes corrected, the twelve boys belonging to the section gather their material on the stone and print a single-page newspaper. On this work the instructor does no correcting at all. It is entirely up to the boys, and if they fail to correct any typographical error, it goes into print over their own name. Frequently

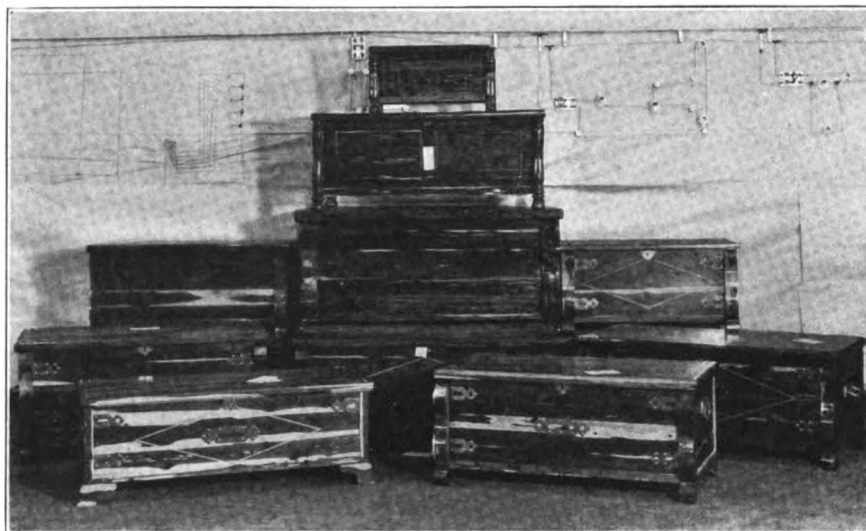
this little paper is illustrated by means of linoleum cuts which add greatly to the interest in the work.

In the ninth grade the boy continues composition work on more difficult jobs, and more time is given to presswork. Part of the time is given to bookbinding, and the making of notebooks with cloth and leather bindings. The boys do all the printing for the entire school system, thus getting excellent practice in real industrial work.

Many boys correlate their work in English by getting out extras about different events that are being studied in the classics. This is very interesting work, both for the English class and the students taking printing.

The equipment consists of a 10 by 15 platen press and one 8 by 11 foot-power press, a 19-in. paper cutter, a stapling machine, 1 font each of 6, 8, 10, 12, 14, 18, 24, 30, and 36 point boldface type. Also the same sizes of art craft book for body type and a few fonts of Old English type. For poster work we have two sizes of wood type, 6-line and 15-line.

Recently we purchased a 10 by 15 and a 14 by 22



CEDAR CHESTS BUILT IN THE WOODWORKING SHOP

platen press at a sheriff's sale for a very small price. These are being rebuilt in our machine shop after which they will be added to our printing equipment.

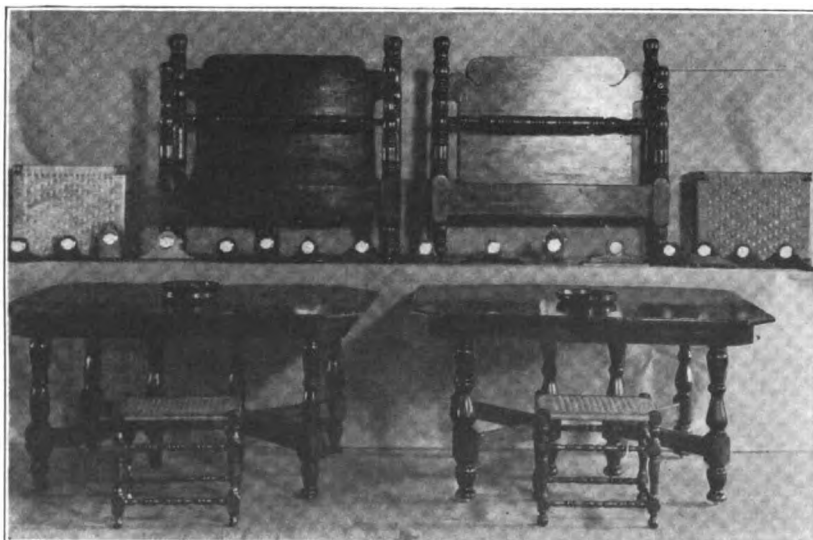
Woodworking Unit

The time spent in the woodworking unit is the same as in all the other units.

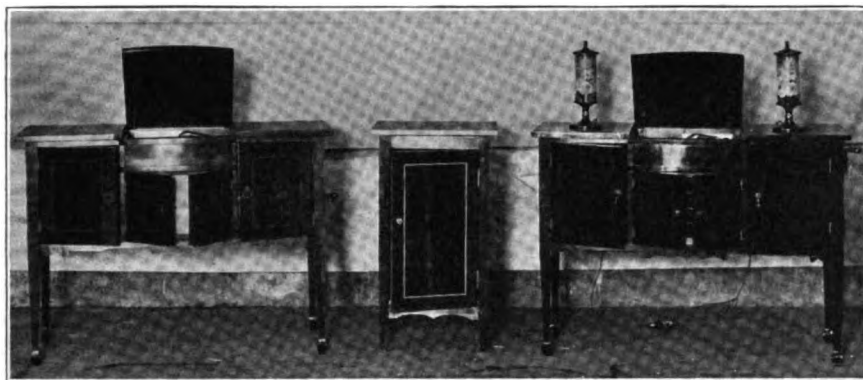
The boys are instructed in the use of the foot rule during the first period. For this purpose a lesson sheet is used which is printed in our printshop from an electrotpe which the Stanley Rule and Level Plant gave to us. This is followed by a similar chart on the saw which we have printed from cuts and material furnished by the Henry Disston & Company. This is followed by getting out stock for the first project, thus introducing the use of both the crosscut and the rip saw. The plane is introduced at this time, for use in surfacing the rough stock. Then the try-square is introduced for testing the surface edges and ends. The next group of projects requires the use of boring tools in addition to the tools with which the student is already familiar. The next group of projects require the fastening together of pieces of wood by means of nails and wood screws, the screws introducing the student to the use of the countersink. Every group of projects involves some new process or the use of some new tool or a different use for the same tool.

Next, the boys are taught the use of stain, filler, shellac, and wax in finishing the projects that have been completed.

In the ninth grade the boys continue the work started in the seventh and eighth grades with projects involving more difficult joints, such as the mortise-and-tenon joint. They are also instructed in the use of machinery, the dangers to be avoided, and to practice safety always. During the ninth year

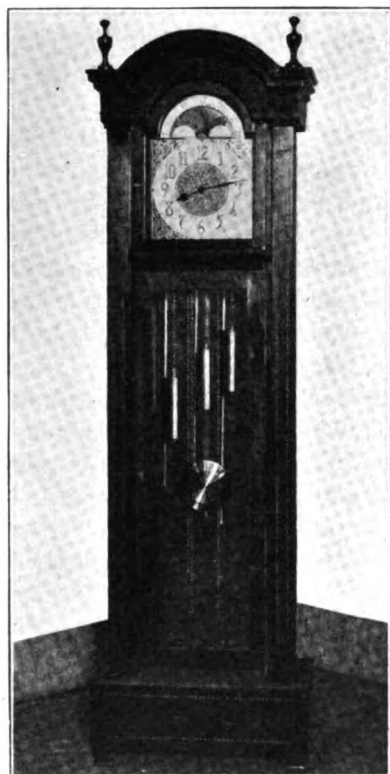


FURNITURE BUILT IN THE WOODWORKING SHOP



FURNITURE BUILT IN THE WOODWORKING SHOP

every boy is required to build one project that involves the weaving of a seat with fiber or chair cane. Many boys do work of this kind during their spare moments at home to make extra money.



THE GRANDFATHER CLOCK

The projects that the boys select in the upper grades are many and varied. Cedar chests are a favorite project. These are built from the rough lumber. The boys do their own gluing, as well as designing and finishing. Inlaying also may be introduced and some outstanding work is often done, as is shown in the illustration. The boy who built the clock brought the lumber for it from his father's farm.

Other projects include bedroom suites, dining-room tables, radio cabinets, and boats. The accompanying illustrations show some of the articles made by the students; also a group of the boats

after they were put afloat on the Susquehanna river.

The equipment consists of 22 benches, each with a tray containing the following tools: 1 back-saw, 1 jack plane, 1 hammer, 1 gauge, 1 try-square, 1 $\frac{3}{8}$ -in. chisel, 1 brush, and 1 steel foot rule.

The machine equipment, which was limited at the opening of our shops, has grown considerably by the addition of one machine per

year. At the present time we have the following machines: 1 double-arbor variety saw, 1 band saw, 1 6-in. jointer, 1 lathe, 1 hollow-chisel mortiser, 1 oil grinder, and 1 24-in. single surfacer.

This year, a shaper will be added. Besides this, the boys in the machine shop are building a belt sander for our shop.

All other hand tools not included in the individual sets, are kept in the toolroom as are also the trays with the bench equipment for each bench. The tools are issued upon presentation of a check, the check being kept by the toolroom keeper until the tool is returned.

Auto Mechanics

Auto mechanics has been introduced a year ago and is yet in the experimental stage. We are able to get old worn-out autos from some dealers for the trouble of taking them away. We remove the different parts and have the boys work on them. Tracing out the wiring system, adjusting different types of clutches, grinding valves and scraping carbon are all practiced by the student. After the motor has been worked over several times, the engine is scrapped, and if it happens to be a motor containing aluminum parts, these are saved and used in the foundry. The balance is turned over to the junkman and other motors are brought in. We are at a disadvantage because our space is limited and we cannot drive right into the shop but must tear down the autos outside and bring in the parts.

Electrical Unit

A 12-week period of 90 minutes per week is spent in the electrical unit. The first period is used to



BOATS BUILT IN THE WOODWORKING SHOP

familiarize the boys with the source of electricity and the study of a common dry cell, its composition and the use of the different parts. Terms common to electrical work are explained. This is followed by a study of a common magnet, and the electro-magnet and its application to the electric machinery of today. The boys now construct a simple electro-magnet.

The next problem involves the study of an electric bell, after which the boy traces the current through the bell. This is followed by exercises in splicing wire, also tapping main wires for branches.

The actual bell wiring is done. The boys draw up plans on paper for an electric bell system, using one bell, a dry cell, and a push button. After their plan is approved, a requisition for the job is filled out, in which the amount of wire, as well as the correct name for each article used on the job appears. After this requisition is approved, the materials for the job are drawn from the toolroom. Then the installation is made on a wiring board, emphasis being placed on dimensions and neat work. After the job is completed, it is tested and graded on dimensions, neatness, and accuracy.

This work is followed by jobs using several bells and push buttons. The boys also construct small battery motors.

In the ninth grade the work of the former grades is continued by the use of more complicated jobs and by the building of transformers to use in connection with bells and other electrical machinery.

House wiring is introduced in the tenth grade, and motors are rewound in the eleventh grade by such boys who may desire to do this kind of work.

The equipment consists of a motor-generator set of 750-watts capacity, a Tungar battery charger, motors of different types, bells, push buttons, telegraph sounders and keys, magnetic telephones, etc.

Plumbing

Every boy in the seventh and eighth grades is given a period of six weeks in plumbing and pipe fitting. He spends 90 minutes each week in this work. Our aim is to acquaint the boy with the tools used by the plumber, the names of the common pipe fittings, sizes of pipe, etc. We stress the repair of common faucets, and have every boy become familiar with the method of shutting off the

water supply in their own home in case a leak in the water system should develop. We have every boy report where the stop and drain is located in their cellar or basement. Also the kind of stop that is used.

His first job is to examine carefully a common faucet which we have cut away on one side to show its interior. After his examination, a drawing of the cross section is made to impress upon the student's mind just how the faucet works, and also to give him practice in sketching.

This work is followed with a job of repairing a faucet. A long bench with plates threaded to receive pipe is used in the shop for the pipe work, and all jobs are built up on this bench. After the work on faucet repair is completed, the job of installing a faucet is taken up. Pipe cutting and threading is introduced on this job.

Each job adds some new difficulty in installation, and unions, reducers, 45-degree fittings, etc., are all introduced.

Boys who select this work in the upper grades continue it by installing storage tanks, drain pipes, etc. Soil pipe calking, and joint wiping also are taught.

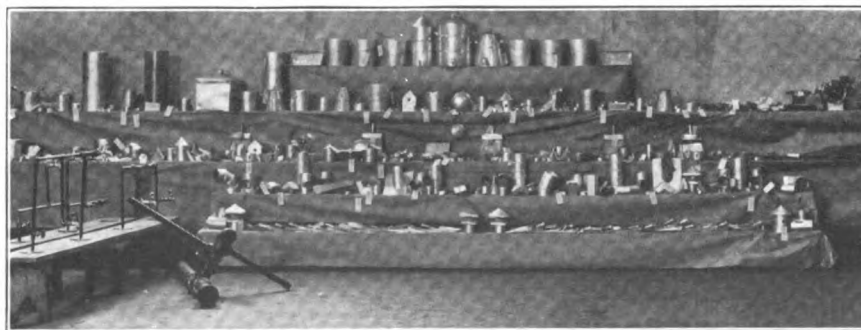
The tools for the plumbing work consist of the more common hand tools, pipe cutters, ratchet pipe dies, reamers, wrenches, and a supply of pipe fittings necessary for the different jobs.

Two boys work together in the plumbing shop, and after they have completed a drawing of the job, they list everything needed on a requisition sheet which is then presented to the instructor for approval. After it is approved it is presented to the toolroom keeper who fills the requisition and keeps the sheet on file. After the job is completed, all the fittings, tools, and pipe are returned, and checked back against the requisition. If everything has been returned, the original requisition is returned to the boys. Thus a check on all tools and fittings is easily kept.

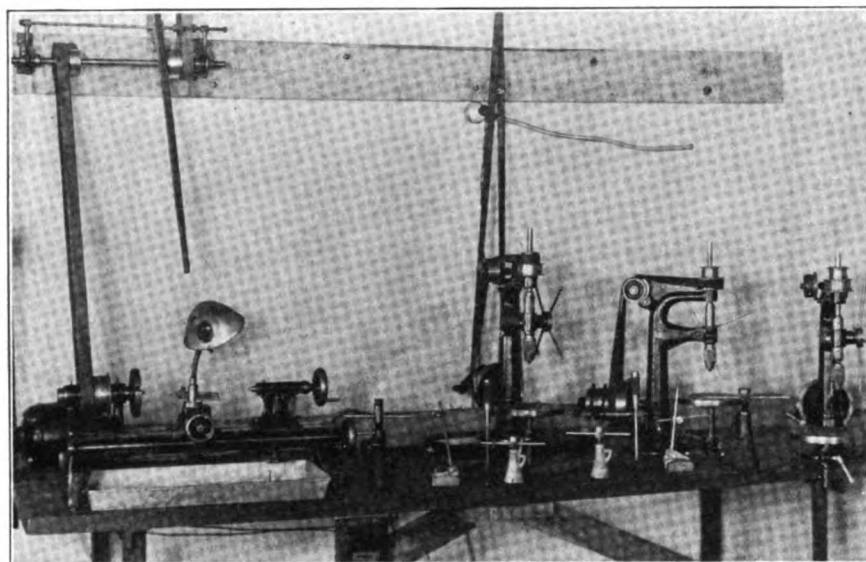
A gas furnace is provided to melt the lead required for soil-pipe calking.

Sheet Metal

Every boy in the seventh and eighth grades is given a period of twelve weeks in the sheet-metal unit of our general shop. He spends 90 minutes



PROJECTS MADE IN THE SHEET-METAL AND PLUMBING SHOP



PROJECTS MADE IN THE MACHINE SHOP

each week in this work. During this period he is to become acquainted with the tools, materials, and methods used by the sheet-metal worker.

During the first week in this unit the boy is taught the principles underlying soldering. He is shown that solder will not unite pieces of dirty or oxidized metal. He is also shown that dirty or oxidized coppers will not pick up solder. The boy is further shown what fluxes to use, and how to prepare them. Then he is instructed how to tin a soldering copper, and he begins his actual work by preparing a copper before he solders his first flat seam. While we do not believe in the exercise method of instruction, yet we thought it wise to let the boy try soldering flat seams on pieces of scrap metal, before he attempts his first seams on projects.

After he has acquired some degree of skill in the use of the soldering copper, we let him select a cookie cutter in which the edge of the metal is reinforced by means of a double hem. In this way he is first introduced to the bar folder. This group consists entirely of such shapes as may be formed on the stakes with the mallet.

The second group again makes use of the double hem, but it is used on circular and semicircular work. In this way the boys become acquainted with another hand machine, the forming machine.

The third group consists of cutters whose edges are reenforced by the use of wire thus involving a new use for the folder and also introducing the use of the wiring machine.

Thus we arrange our projects in a series of groups, each group involving some new teaching point or a different method of doing an old operation. Other projects used are dustpans, match boxes, toy boats, flour scoops, cemetery vases, etc.

The boys who select sheet metal in the ninth grade and above the ninth, make their own patterns on paper and afterward make them up in sheet

metal, thus obtaining an opportunity to prove the accuracy of their layout.

The equipment for twelve boys consists of: 4 gas furnaces, 1 bar folder, 1 grooving machine, 1 forming machine, 1 turning machine with elbow edging rolls, 1 wiring machine, 1 beading machine, 1 small burring machine, and the usual collection of mallets, riveting hammers, punches, etc. The boys are also given an opportunity to do work in copper. Beautiful trays, watch fobs, lamps, and porch lanterns have been produced in these classes.

Machine-Shop Unit

Every boy in the seventh and eighth grades is given a period of twelve weeks in machine-shop work. The aim in this unit is to acquaint the boys with the common tools used in the modern machine shop, and something about the materials which enter into machine construction.

One period per week, 90 minutes in length, is allowed for this work. To accomplish our aim, we select projects that are cheap, useful, and have an appeal to the boy. We try wherever possible to have a group of projects that involve the same tool processes in a class and let the boy select the project he wishes to make.

In the first group we have a collection of brackets for wall-shelf supports, etc. These all require practically the same tool processes, bending and forming cold metal, drilling, sawing, countersinking, and riveting.

In the second group we list projects that use a repetition of the tool processes in group 1, and also involve bending and forming by the use of heat. Garden trowels, door hasps, gate hooks, etc., are some of the projects made.

The next group includes the making of hammer heads of all sizes and shapes. Riveting hammers seem to be the most popular. These are constructed from cold-rolled steel and the boys are taught the process of casehardening.

The next group consists of screw drivers and chisels, using tool steel. The boys are taught to distinguish between tool steel and cold-rolled steel. Tempering of tool steel is also taught.

In the ninth grade, this work started, it is continued with projects that involve new processes, and also with machine work. Hack-saw frames, surface gauges, dividers, etc., are made.

The boys also construct lathes for metal and wood turning, bench saws, scroll saws, gas engines, water motors, vises, screw jacks, etc. Much of the

equipment in use in our shops has been built in the machine shop by our students. At the present time we are building a belt sander for the use in the woodworking shop.

Our equipment is not elaborate. In addition to the usual collection of hand tools, we have the following machine equipment: 1 20-in. drill press, 1 13-in. quick-change lathe, 2 junior lathes, 3 bench lathes (built by boys), 1 drill press (built by boys), 1 grinder (built by boys), 1 shaper, and 1 power hack saw.

Industrial-Arts and Vocational Education in a City of 45,000

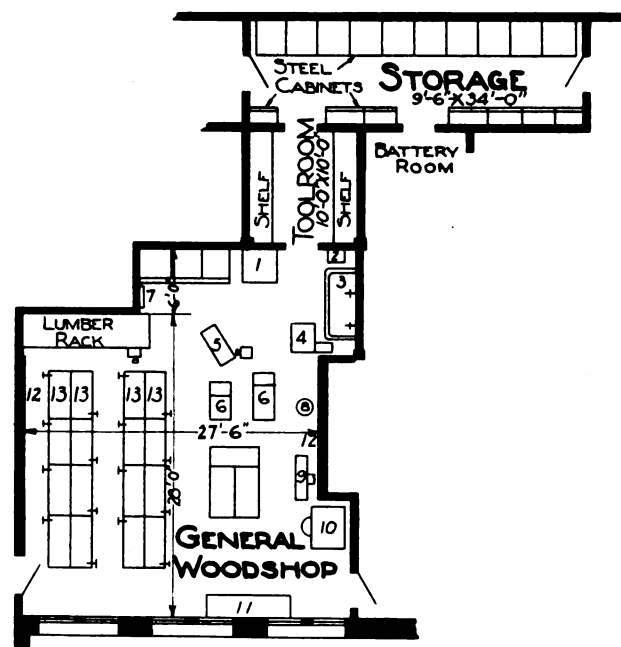
G. H. Parkes, Director of Vocational Education, Williamsport, Pennsylvania

The school system of Williamsport, Pa., operates under the 6-3-3 plan. During the three-year junior-high-school course, two hours per week of industrial arts is required of all students. The activities are as follows:

Metal shop	Woodshop
Electricity	Auto mechanics
Printing	Drafting

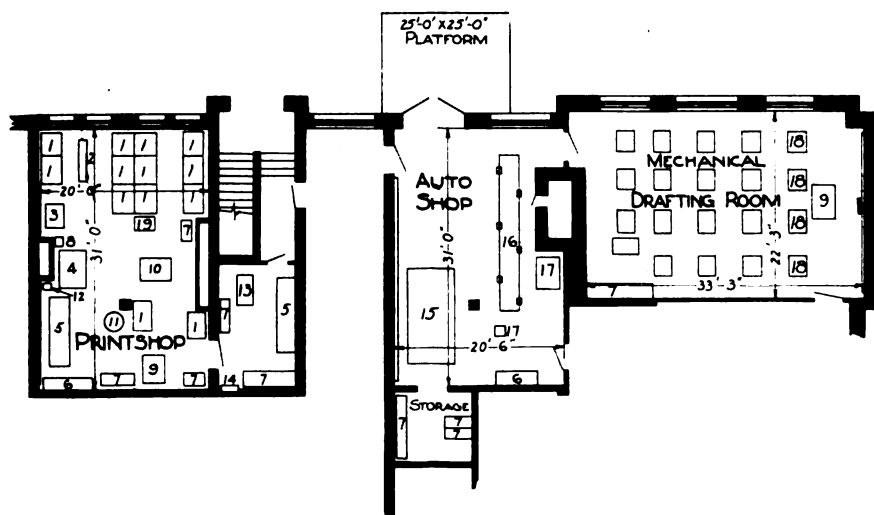
The usual industrial-arts objectives are recognized, although the major objective is at present exploration. With this major objective in mind, the courses have been planned to correspond approximately to those in the senior-high-school industrial course. Since these vocational courses have been organized after extensive surveys of the local industries, it can be assumed that the industrial-arts activities represent the basic industrial activities of the community.

There are three centers of industrial arts: the Andrew G. Curtin Junior High School; the Theodore Roosevelt Junior High School; and the Thaddeus Stevens Junior High School. The Andrew G. Curtin Junior High School contains a unit printshop, a general woodshop, a general metal shop, a



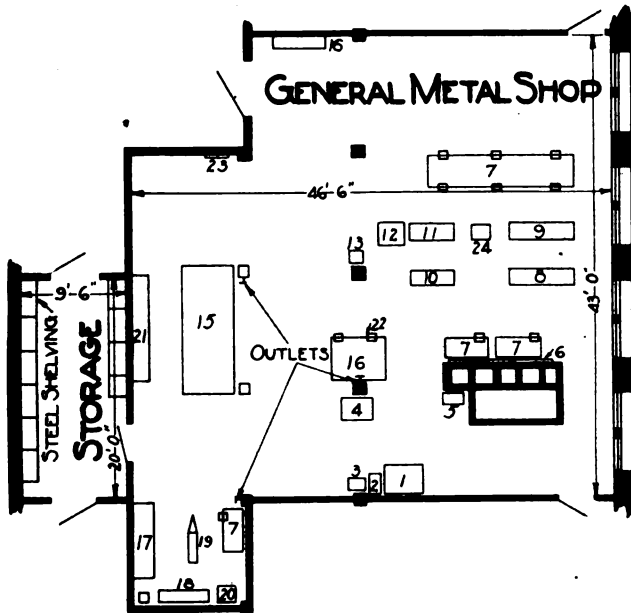
ANDREW G. CURTIN JUNIOR HIGH SCHOOL, WILLIAMSPORT, PA.

1. Grinder
2. Glue
3. Sink, Drinking Fountain
4. Band Saw
5. Planer
6. Lathes
7. Switch Box
8. Sander
9. Jointer
10. Desk
11. Finishing Table
12. Tool Board
13. Benches
14. Blackboard



ANDREW G. CURTIN JUNIOR HIGH SCHOOL, WILLIAMSPORT, PA.

1. Compositor's Cases
2. Proof Press
3. 6 x 9 Hand Press
4. 10 x 15 Platen Press
5. Worktable
6. Sink
7. Material and Storage Cabinets
8. Galley Cabinet
9. Desk
10. Composing Table
11. Stitcher
12. Electric Motor
13. Paper Cutter
14. Switch Box
15. Chases
16. Workbench with Machinists' Vises
17. Engine Stands with Engines
18. Drawing Tables
19. Galley Rack



ANDREW G. CURTIN JUNIOR HIGH SCHOOL,
WILLIAMSPORT, PA.

- | | |
|------------------------------|----------------------------------|
| 1. Teacher's Desk | 14. Soldering Bench and Vise and |
| 2. Filing Cabinet | Furnace |
| 3. Blue-Print Cabinet | 15. Electricians' Wiring Rack |
| 4. Drawing Desk | 16. Sink, Drinking Fountain |
| 5. Teacher's Locker | 17. Molder's Bench |
| 6. Blackboard | 18. Forge |
| 7. Machinist Bench and Vises | 19. Anvil |
| 8. 13"x 5' Lathe | 20. Molder's Furnace |
| 9. 12"x 4' Lathe | 21. Steel Supply Rack |
| 10. 9"x 4' Lathe | 22. Pipe Vise |
| 11. 10"x 5' Lathe | 23. Switch Box |
| 12. 1/2" Drill Press | 24. 9" Tool Grinder |
| 13. Hot Plate | |

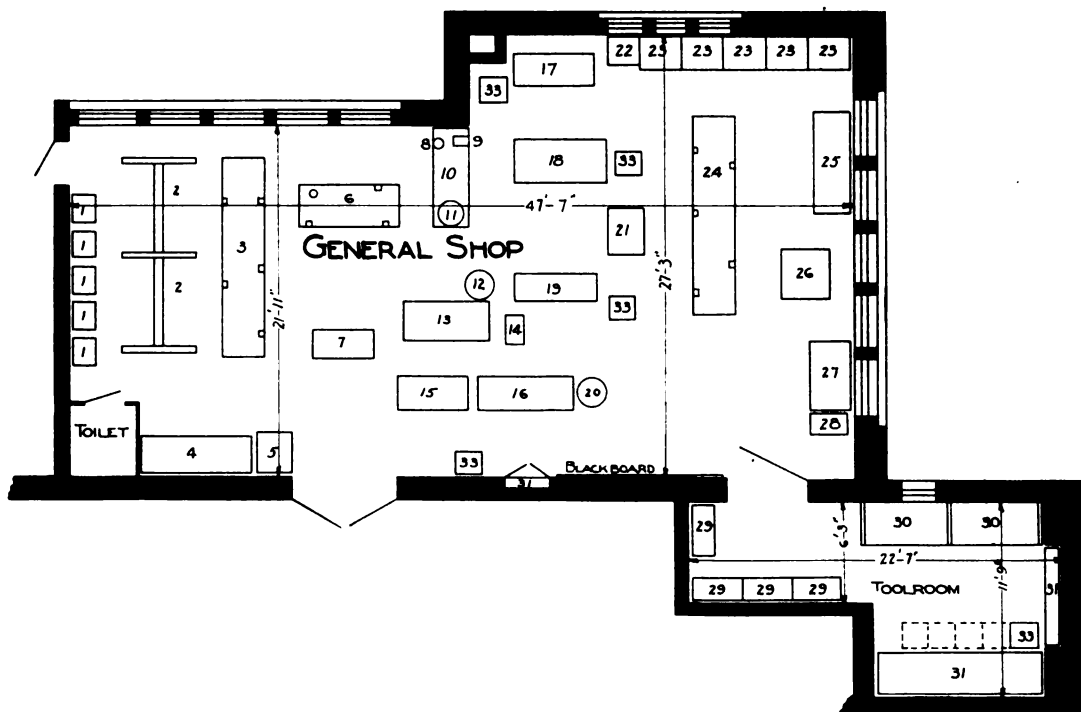
unit drafting department, and a unit auto shop. These shops are manned by three teachers.

The Theodore Roosevelt Junior High School contains a general woodshop, a general metal shop,

and a unit printshop. The drafting is carried on as an activity in the general woodshop, and the electricity is carried on as an activity in the general metal shop. This school is in a center of manufacturing population, and in consequence it is organized and equipped to offer the utmost in training for the boy who will leave school at an early age. There are three full-time teachers in this organization.

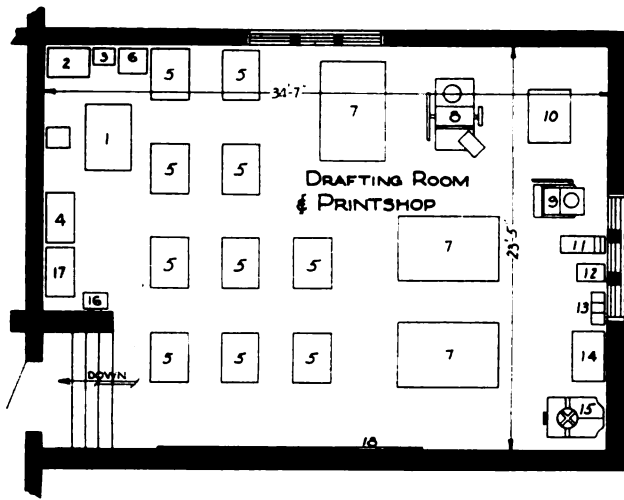
The Thaddeus Stevens Junior High School is situated in a center of professional population, and enrolls a minimum of the vocational type of student. The school is organized to meet the needs of the student who intends to go to college. It contains a combined printing and drafting shop, and a five-activity general shop. The five activities are, molding, electricity, woodwork, metal work and auto mechanics, all of which are carried on simultaneously by one teacher who is in charge of a group of twenty students. Individual lessons and job sheets play an important part in keeping this interesting shop running smoothly.

The programs are usually laid out to permit each boy to sample each activity for a short period each year, so that the various activities will have an equal weight in his selection of a senior-high-school course at the conclusion of the junior-high-school period. During the ninth grade, at the discretion of the junior-high-school principal, problem stu-



THADDEUS STEVENS JUNIOR HIGH SCHOOL, WILLIAMSPORT, PA.

- | | | | |
|------------------------------------|--------------------------------|-------------------------------|---------------------------------|
| 1. Lavatories | 12. 15" Disk Sander | 21. Grinder | 31. Steel Shelving for Supplies |
| 2. Wiring Booths | 13. 30" Band Saw | 22. Blue-Print Cabinet | and Project Storage, Height |
| 3. Workbench, 5 Vises | 14. Arbor Press | 23. Storage Cabinets | 6' |
| 4. Molding Tub | 15. Wood Lathe, 12" swing, 24" | 24. Workbench, 5 Vises | 32. Inclosed Switchboard |
| 5. Melting Furnace | between Centers | 25. Scrap Box | 33. Steel Trucks—These trucks |
| 6. Workbench, 3 Vises and 1 | 16. Wood Lathe, 12" swing, 36" | 26. Motor Stand with Motor | hold all of the tools and fix- |
| Miter Box | between Centers | 27. Instructor's Desk | tures for the lathes by which |
| 7. Thickness Planer | 17. Metal Lathe, 9", 4' Bed | 28. Filing Cabinet | they are stationed. At the |
| 8. Glue Pot | 18. Metal Lathe, 13", 5' Bed | 29. Steel Shelving for Tools, | end of the day they are |
| 9. Bench Furnace | 19. Metal Lathe, 11", 4' Bed | Height 7' 3" | moved into the toolroom to |
| 10. Workbench | 20. Galvanized Waste Can | 30. Metal Rack | positions outlined. Dimen- |
| 11. Electric Drill with Stand 1/2" | | | sions 18"x 20" |



THADDEUS STEVENS JUNIOR HIGH SCHOOL,
WILLIAMSPORT, PA.

- | | |
|--------------------------|--------------------------|
| 1. Instructor's Desk | 10. Imposing Stone |
| 2. Filing Cabinet | 11. Proof Press |
| 3. Instrument Cabinet | 12. Ink Slab |
| 4. Drawing Supplies | 13. Stitcher |
| 5. Drawing Tables | 14. Type Cabinet |
| 6. Cutter | 15. Paper Cutter |
| 7. Type Stands | 16. Lead and Slug Cutter |
| 8. 8" x 12" Platen Press | 17. Printing Supplies |
| 9. 7" x 11" Platen Press | 18. Blackboard |

dents may elect additional shop-work in the activity which attracts them most. This is not permitted except where the possibility of the student electing a college-preparatory course in the senior high school is extremely remote.

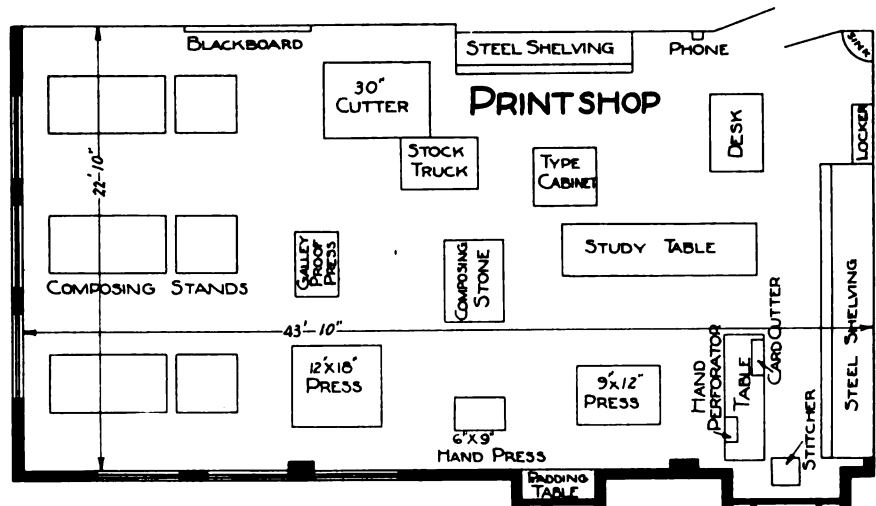
All junior-high-school industrial-arts activities are under the direction of the principal, with the city supervisor acting in an advisory capacity. At present there is no industrial-arts program in the senior high school, although such a program is being planned as an elective course for college-preparatory students as soon as building facilities can be provided.

The all-day industrial organization consists of ten teachers and about 250 students, with six major shops. This industrial education begins with the tenth grade, and runs through three years. Officially, this three-year course is broken up into a two-year unit trade course followed by a one-year cooperative course. Actually, the cooperative course is indefinite in length, the transfer from unit trade to cooperative courses being made on the basis of age, achievement, and the demands of industry, rather than upon an arbitrary school-grade basis.

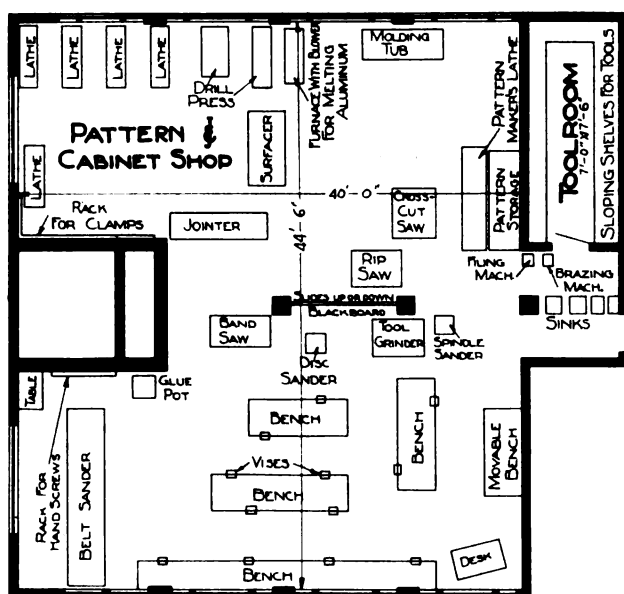
Six basic trades are taught in the unit trade course:

- | | |
|---------------|-------------------------|
| Patternmaking | Electrical construction |
| Printing | Machine-shop practice |
| Woodwork | Auto mechanics |

In this unit trade program, craftsmanship training is not considered the major objective, although a fair proportion of the students achieve this level, and find high-grade employment in local plants.



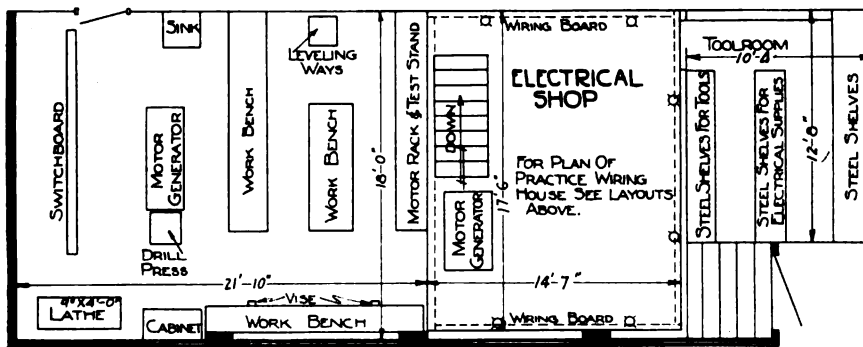
SENIOR HIGH SCHOOL, WILLIAMSPORT, PA.



SENIOR HIGH SCHOOL, WILLIAMSPORT, PA.

It is felt that the demand for the all-round workman, while ever-present and consistent, is far eclipsed by the demand for young men who can work upward through the production organizations. Instead of training twenty boys for the machinist trade, for example, with most of them dropping out before graduation to become specialists and machine operators, it is a better plan to sift the group carefully, and to train the boys for the great machine industry. The boy with toolmaking abilities is trained for the toolmaking job, and the boy with the machine-operator capacities is trained for the machine-operator job, keeping in mind always that equality of opportunity is demanded in a democracy, and that the way upward must be kept open to every boy.

Fifteen hours a week are spent in the school shops by the unit trade students. The department is organized on a two-week alternate basis, the boys



SENIOR HIGH SCHOOL, WILLIAMSPORT, PA.

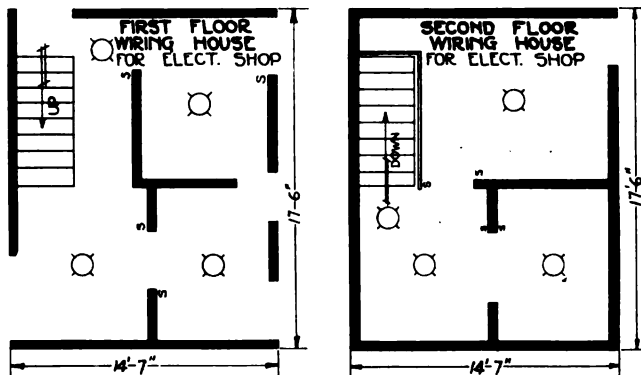
and twelfth grades, with the approval of the faculty. The unit trade course, alternating shop and classes two weeks about, acts as a reservoir for the cooperative course. It is understood that most of the boys will remain in the unit trade course for about two years, but many over-age or exceptional boys enter the cooperative course earlier. During the in-school period, the cooperative students study:

Related drafting	History
Related mathematics	English
Economics	Related science

In all courses, drafting, mathematics, and science are related to the trade through semi-Dalton-Plan instruction. Economics, history, and English are general in nature, and lean only slightly toward the industrial.

The Equipment Policy in Williamsport

Insofar as possible, the industrial-arts and industrial departments operate as a staff organization, so that the present equipment policy is the result of a large number of conferences, and represents the recommendations of seventeen experienced men.

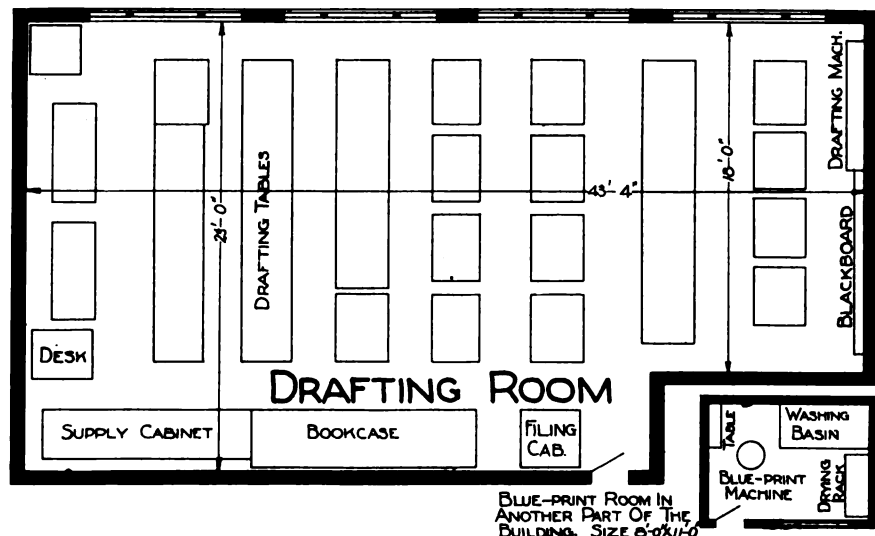


WIRING HOUSE FOR THE ELECTRIC SHOP

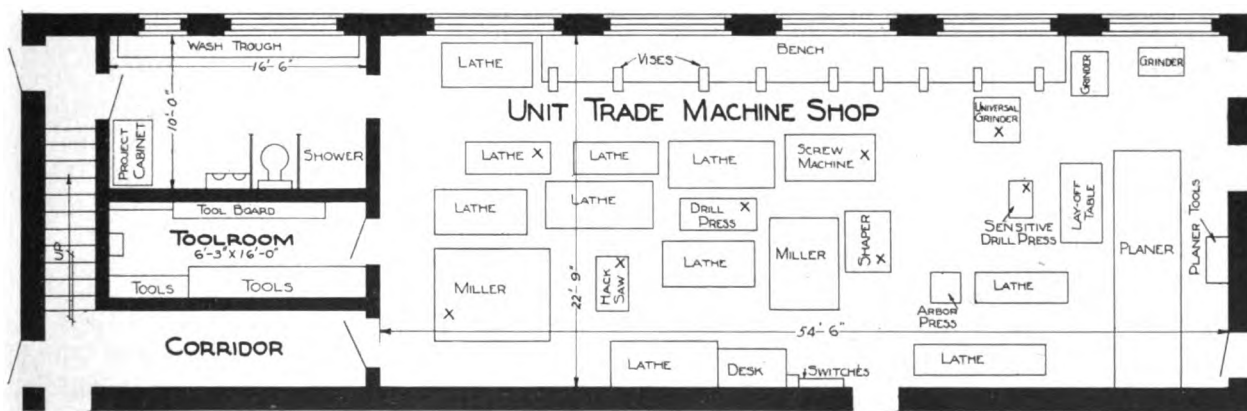
working in the school shops for a two-week period, and returning to the classrooms for related and academic instruction for a two-week period. This long period in shop and classroom is an excellent device to permit full correlation between the unit trade and cooperative courses. In addition to shopwork, the unit trade students study:

Related drafting
Related mathematics
General mathematics
History
English

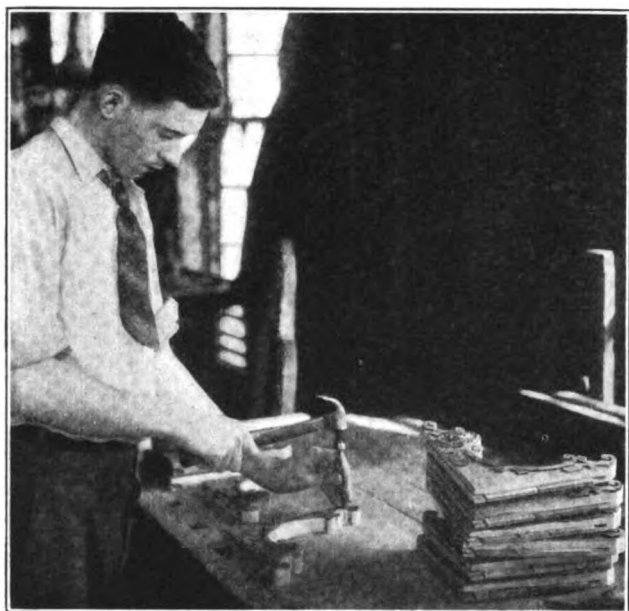
The cooperative course is open to students of the tenth, eleventh,



SENIOR HIGH SCHOOL, WILLIAMSPORT, PA.



SENIOR HIGH SCHOOL, WILLIAMSPORT, PA.



CABINETMAKER APPRENTICE

Since, in the industrial-arts departments, the objective is largely exploration, it is the policy of the schools to purchase for these shops, equipment that approximates local manufacturing equipment: machine tools designed especially for schools are avoided, and semiproduction equipment that is known to be used in industry is selected instead. The present tool and machinery outlay for industrial arts is approximately \$25,000, covering a three-year purchasing program. The policy has been to buy a few well-built, standard tools rather than a larger number of light-duty, poorly constructed units.

All equipment is placed on the floors with an eye to convenience of use, and efficient operation. Each machine is equipped with individual motor drive from 220-volt, 60-cycle, 3-phase power lines. No light-socket, light-duty equipment has been purchased to date, with the exception of some portable



APPRENTICE AUTOMOBILE MECHANIC

electric drills. These electric drills are purchased in preference to the breast or hand drills commonly found in school shops. They are used freely by the students, because, in the opinion of the staff, the hand or breast drill is almost obsolete as a manufacturing tool, or at least will be obsolete before the boy functions in industry. The probable industrial standards of seven or eight years from the present are carefully considered in selecting hand or machine tools. Another example of changing tool equipment, is the substitution of the disk sander for the block plane, and the thickness planer for the elbow-exercising jack plane.

It has been part of the policy to keep to a minimum the instructor-operated machine tools. Each industrial-arts woodshop contains a 30-inch standard band saw which is not operated by the students, and one shop contains a 9-inch jointer, also not operated by the students. Aside from these machines, all equipment is operated freely by the students. There are no circular saws in the industrial-arts departments, projects being designed to avoid the use of such saws. The vocational shops contain all student-operated machinery.



APPRENTICE DRAFTSMAN

Equipment Obsolescence

The vocational staff is somewhat concerned about the obsolescence of machine-tool equipment. The vocational teachers operate in extremely close contact with local industries, and in attempting to obtain a reasonable approximation to industrial standards of finish and production speed, it is quickly discovered that equipment purchased ten years ago for the school shops is not sufficiently rigid or powerful enough to furnish adequate instruction in modern practice. This is especially true in the machine shop, and the staff is faced with the problem of replacing almost the entire present machine-tool equipment in this shop.

It is the opinion of the men concerned, that no unit trade equipment should be purchased which is not speedy and rigid enough to load to capacity a five-horse-power motor. The heavier machines, such as planers and milling machines would, of course, need much larger motors.

Specifications for Small Tools and Supplies

Those charged with the supervision of vocational and industrial-arts shops are frequently confronted with the paradox of the teacher-mechanic who is unable to specify his tools and supplies, so as to guard against substitution. Where the materials and tools are purchased through business managers or purchasing agents, it becomes a problem for the supervisor to so write his material lists that his teachers will receive exactly the article desired.

This particular school district has operated shops for many years, and through experiment and experience, a list of specifications covering the more commonly used tools and materials has gradually evolved. The list at present contains nearly one thousand items, each item specifying a tool or unit of material that has by experience been found to be satisfactory as to quality, convenient as to package, size, and readily obtainable. The list is constantly changing, as flaws appear or better tools are marketed, but the large bulk of the list remains constant. Trade names do not appear unless it is absolutely necessary to avoid substitution.

This list is printed on thin tracing paper, so that it may later be duplicated by blue printing. Opposite each item, there is provided a column for each school or department to indicate the quality desired. Once each year, as the annual budget is made up, the teachers concerned meet to fill in the amounts for their respective organizations. The amounts required are noted on the tracing paper in india ink, and totaled. This series of tracings then becomes the master list, from which blue prints are made. The blue prints are submitted for bids, and used to check the material as it arrives after purchase. The linotype slugs from which the list is printed, are retained from year to year.

The blue-printing process is preferred to other and less-expensive duplicating processes for several reasons, the most important of which is the lack of skilled stenographic assistance in schools. Then too, the instructors are more familiar with the blue printing, and are themselves able to make erasures or changes in the tracing if necessary. The blue printing of the one master list also insures that each bidder, checker, instructor, or other person using the list, will have an exact duplicate of the master.

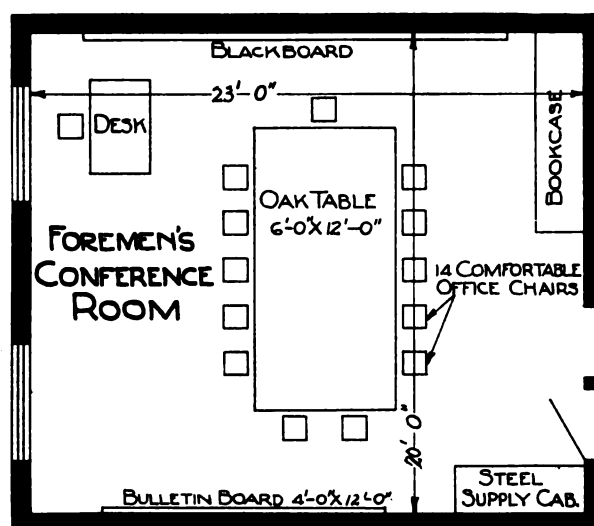
The Continuation School

Williamsport contains an extremely small percentage of working children under 16 years of age, and, consequently, the continuation-school enrollment is about fifty boys and girls. Under the Pennsylvania laws, the continuation school operates eight hours per week, each student being required to attend industrial, or home-economics classes for two hours per week. At present the continuation school is housed in an elementary-school building, and the boys and girls travel to one of the junior high schools where they receive their practical work

in the industrial-arts shops or in the home-economics laboratories. Junior-high-school teachers of these subjects remain after the close of the regular day, and teach these classes. The arrangement is not at all satisfactory, and it is planned to house this school with all of its activities in the vocational-school center as soon as building facilities can be obtained.

Adult Education

The school district operates Americanization classes, classes for foreign women and an extensive program of evening industrial and home-economics



SENIOR HIGH SCHOOL, WILLIAMSPORT, PA.

courses. The evening industrial courses are an integral part of the vocational program, and is conducted in close cooperation with local industries. Most of this instruction is related and technical in nature, although shop classes in auto mechanics and machine-tool operation are very popular.

The foremanship conference program, organized as an evening-school activity, with the active cooperation of the local chamber of commerce and local manufacturers, has been quite successful, and has been a valuable contact medium between school and industry. Much of the success of a cooperative program depends upon securing the cooperation of the foreman on the firing line in industry, and many cooperative opportunities are opened up through the foremanship work. This foreman conference work is, of course, very valuable in itself, and is organized primarily for the benefit of local industries and their employees. The vocational director acts as conference leader, assisted where possible by men from the respective plants. An evening program of training for prospective foremen is also being provided for the young man who wishes to fit himself for a responsible position in industry. A considerable portion of the prospective foreman material consists of vocational graduates or former students, for whom the evening classes are an extension of their trade training.

Industrial-Arts and Vocational Education in a City of 300,000

F. R. Cauch, Supervisor of Vocational Education, Oakland, California

The school system at Oakland, California, is organized on the 6:3:3 plan, and the fact that grades 7, 8, and 9 are housed in schools separate from grades 10, 11, and 12 naturally affects the work that is being done in industrial-arts and vocational fields. In the elementary schools, in kindergarten and grades 1 to 6, industrial arts as such is not taught, but the work is made to fit into the study of English, social studies, etc., so that it becomes an integral part of the regular course of study. Our building plans call for an occupational room for each elementary school, these rooms to be fitted up in a very elementary way so that pupils can do there the things that cannot very well be done in the ordinary classroom.

For several years, different groups of teachers have been giving special study to the field in which they were especially interested. As a result of this study, they arrived at certain conclusions and they have tried to shape up the work done in the junior high and high schools to meet these conclusions. All courses used in the Oakland system are the product of a group of teachers rather than of one man. The shop faculty consists of over one hundred teachers, and one can imagine that in a group as large as this there will be a great variety of training and experience. Some have trade experience without college training, others have trade experience with normal or teacher-college training; still others, trade experience with university training. There is still another group with normal, teacher-college, or university training and no real trade experience. So the variety in training and experience to be found in a group lends itself to variety in thought, aims, and ideals, and the tendency will be to consider any subject in its broadest aspect.

The junior high school is a place for experimentation and exploration. If this be true, then the number of different types of exposure should be as great as possible. It is very difficult, because of financial conditions, and lack of room, to equip each junior high school with as many individual shops as are necessary in order to give the requisite number of tryouts. This being the case, the policy in Oakland has been to establish three or four individual shops in each junior high school of 1,200-pupil capacity and one home-mechanics or general shop in which a boy can come in contact with from four to six different types of work. The types of work given in the home-mechanics or general shop depend upon what types are given in the individual

shops, this varying in different schools. Some time ago the junior-high-school principals approved of the following schedule of subjects to be taught, the time given being three 60-minute periods per week for twenty weeks. The work is required of all boys.

Low 7—Woodwork.

High 7—Sheet Metal, Shop Drawing, or Additional Woodwork.

Low 8—Home Mechanics or General Shop.

High 8—Required as to work, but elective as to subjects. The electives being taken from the foregoing, or electrical work or printing may be chosen.

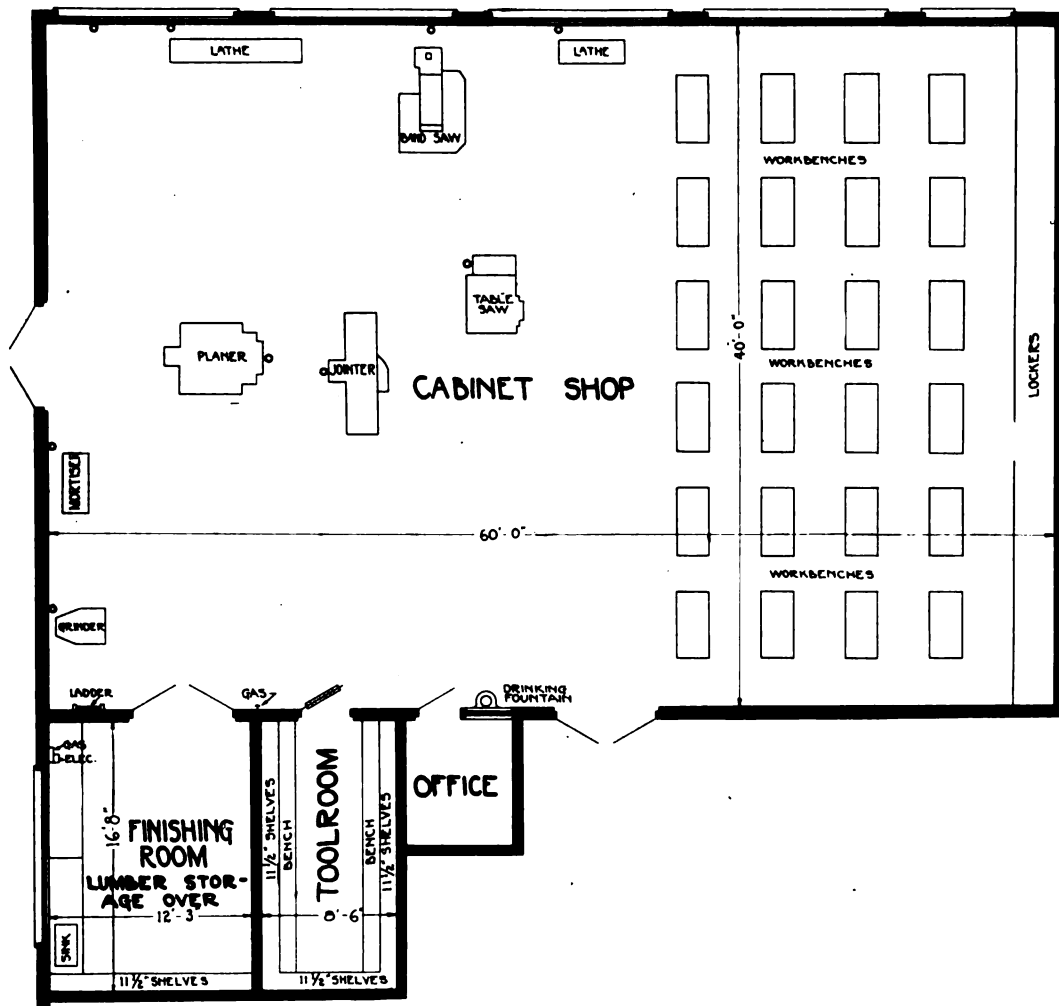
Low 9 and High 9—Entirely elective.

Children of superior ability are given an enriched curriculum by means of special assignments. On the other hand, pupils of limited capacity may work on the same project assigned to the class, but it is not expected or required that they reach the same standards of attainment as those of greater ability. In this way each teacher may give reasonable recognition to individual differences even though no definite segregation into separate groups on the basis of ability has been made.

Junior-High-School Woodwork

In every junior high school there is one shop accommodating 24 pupils, equipped with standard, modern, motor-driven woodworking machines. Each shop is 40 by 60 ft., in addition to which there is an office for the instructor, toolroom, and finishing room. The space over the office, tool, and finishing rooms, is used for lumber storage, a small amount of material being kept on the main floor. In addition to the power machinery, there is a standard equipment of hand tools. Good equipment and tools are supplied, because the boy should be taught to respect and take care of his tools. This is impossible if he is asked to make use of poor tools with which he cannot do good work. The woodworking course is not divided into work by grades but by semesters. In this way a boy may do one or two semester's work in the seventh grade. If he elects woodwork in the high eighth or in the ninth grade, he can go on from where he left off.

There are no cut-and-dried courses of study. There are certain principles which are to be taught each semester, and the boy is given a choice of a number of articles, the making of which will teach those principles. Each teacher has a long list of projects that will supplement the work which he is teaching; hence there is no lost time when a boy has finished a project before he is ready to com-



CABINET SHOP, OAKLAND PUBLIC SCHOOLS, OAKLAND, CALIF.

mence on the next one. The pupil is required to do the work which it was planned to do, and what make a sketch or working drawing of a project before he commences its construction. This helps changes could be made in the planning or the execution which would make it better? Under no circumstance him to understand just what he is going to do, and how he is going to do it. In the advanced classes, we try to develop an understanding and appreciation of industrial activities and sympathy toward the productive members of society, a proper attitude toward manual work, and the ability to recognize good workmanship. There are four things that guide us in the selection of work to be done by the boys:

1. Is the project of sufficient educational value?
2. Is it adapted to the pupil's constructive ability?
3. Can it be completed within a reasonable time?
4. Is the available equipment sufficient for its execution?

Constructive criticism of the work is given throughout the period of its construction. The criteria for judging are: Will the finished article

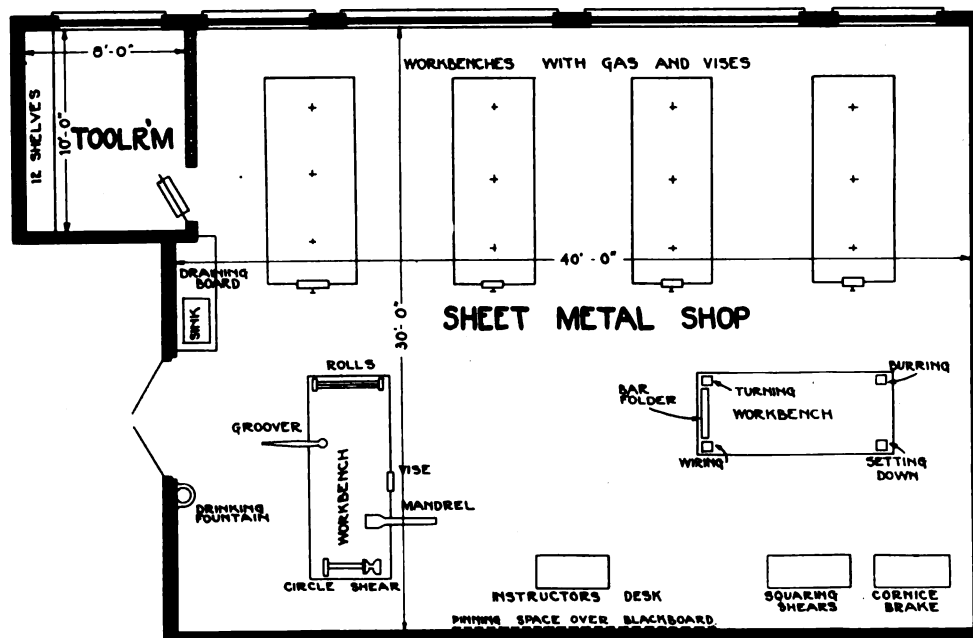


CABINET SHOP, UNIVERSITY HIGH SCHOOL, OAKLAND, CALIF.

cumstances should the teacher fail to give a pupil credit where credit is due.

Sheet Metal

The standard size of the junior-high-school sheet-metal shops is 30 by 40 ft., with additional space for an office and a toolroom. These shops are equipped to accommodate 20 to 24 pupils.



SHEET-METAL SHOP, OAKLAND PUBLIC SCHOOLS, OAKLAND, CALIF.

Gas furnaces, workbenches, squaring shears, cornice brake, beaders, and all the necessary modern tools are furnished so a boy may be able to work out almost any elementary project.

To prepare students to think logically is one of the fundamental purposes of the school, and the course in sheet metal gives ample opportunity for the exercise of the reasoning powers. We believe there is nothing better than sheet-metal-pattern development to make pupils think. In addition to this, the course is intended to teach the processes and principles which are necessary to master the subject. The processes and principles taught are as follows:

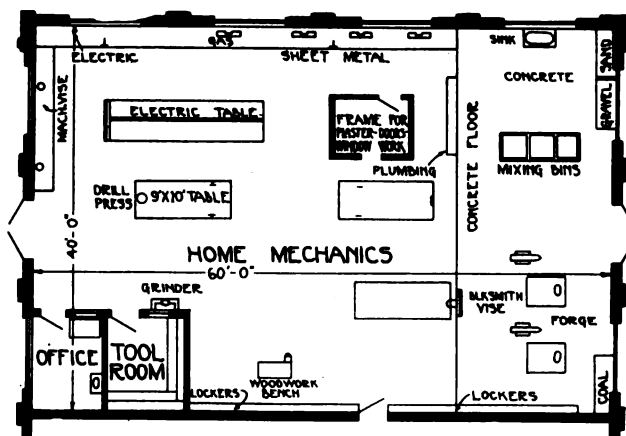
Soldering, transferring patterns, cutting and edging, wiring, seaming, notching and burring, double seaming, radial line development, pans and pan corners, parallel line development, moldings and miters. These are developed in a very simple way during the first twenty weeks. If the pupil elects additional work, there is a repetition of the processes and principles designated by giving more difficult applications. In every case extra and desirable projects are provided, to be made by the more gifted students who finish ahead of schedule.

Home Mechanics

In our system, we distinguish between the home-mechanics and the general shop. As its name implies, the home-mechanics course aims to develop in the student the ability to repair the simpler articles which may need repairing in the home. It aims specifically at relating the job to the boy's immediate interest, having in view the value of the project after its completion. It aims to explore occupational opportunity so that the boy may be

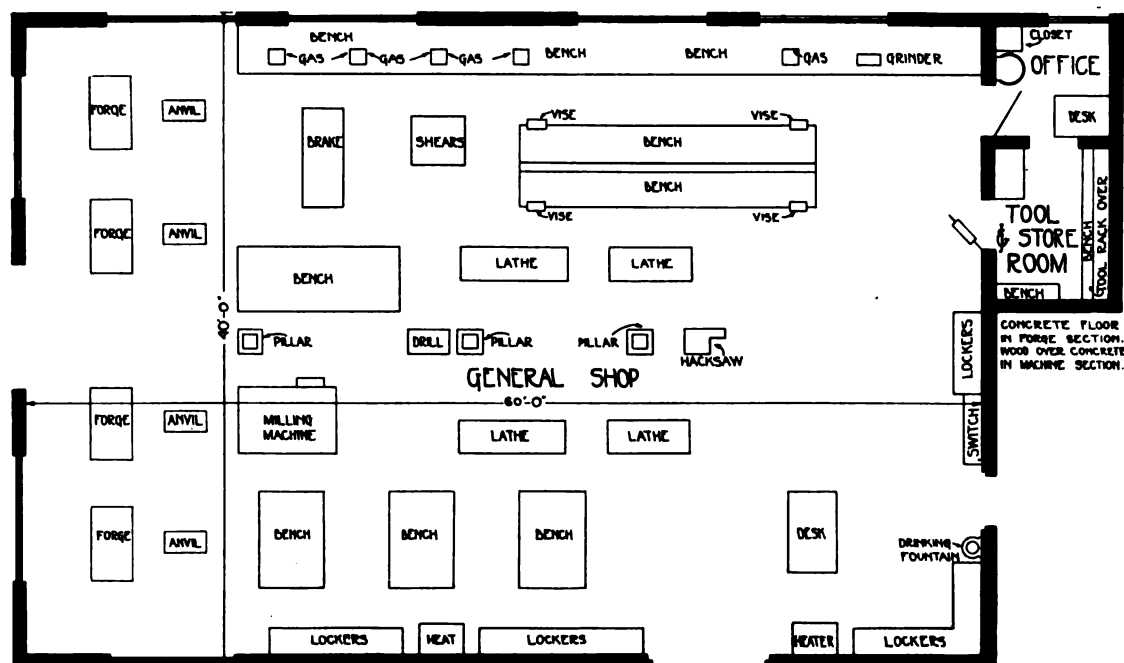
benefited through contact with the several mechanical activities taught in the home-mechanics shop.

1. The course of study is flexible; first, depending on the location and equipment of the school, and second, providing for proper recognition of individual differences, thus meeting the interest and abilities of all students.
2. The method of procedure is definitely along the lines of the best mechanical practice at all times and on all projects.
3. The proper use and care of tools is emphasized.
4. The criteria of the home-mechanics work is based on six activities centering around the shop



HOME-MECHANICS SHOP, OAKLAND PUBLIC SCHOOLS, OAKLAND, CALIF.

in relation to the home, at least four of which are chosen to make up one unit, keeping definitely in mind that throughout the system the shop organization is uniform in terms of (a) experimentation, (b) investigation, (c) observation, (d) construction, and (e) purposeful reading and discussion.



STANDARD DETAIL GENERAL SHOP, JUNIOR HIGH SCHOOLS, OAKLAND, CALIF.

The six activities given in home mechanics are concrete and cement, electricity, forge, plumbing, sheet metal, and miscellaneous. Under miscellaneous we are able to gather all odd jobs in the home that do not come under either of the other classifications. In the course of study, specific objectives are given under each activity, and book and magazine references are listed.

The teacher is aided very materially in his work by means of job sheets that have been worked out by the home-mechanics-teacher group or obtained from other sources.

General Shop

The general shop differs from the home-mechanics shop in several particulars. Concrete and cement are not given. The equipment for forge, sheet metal, electricity, and plumbing is quite complete, and equipment for elementary machine shop is introduced. The aim is entirely different, the course being essentially prevocational in nature. The purpose is to cover the fundamentals in each of the departments with certain basic projects, and then suggest a series of problems, which it is believed will be of value to all.

The student is given information pertaining to the various activities in which he is engaged; wages received in the community, number of hours worked per day, industrial hazards, actual shop conditions, etc.

The general objectives are:

1. To expose the student to as many vocational

activities as is possible in the general shop, so as to discover and direct his abilities and interests.

2. To develop skills and appreciation such as will be valuable in the economic upkeep of the average home.

3. To aid in the selection of a vocation or avocation.

4. To give a more definite understanding of industrial conditions.

5. To develop the ability to do independent work.

6. To better fit the student to earn a living if



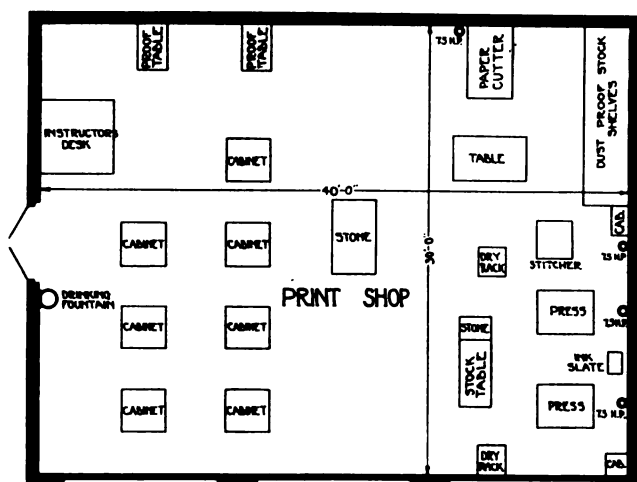
GENERAL SHOP, UNIVERSITY HIGH SCHOOL, OAKLAND, CALIF.

forced by economic or other conditions to leave school in the ninth year or sooner.

While we have a course of study worked out for the general shop by the teacher group, the fact that shop conditions are not the same, makes it necessary to depart from the course as expediency and experience may dictate. Job sheets have been developed and are used throughout the course, thus making individual instruction possible.

Printing

The primary purpose of a printing course in the junior high school is printing-trade exploration and language study. An effective course in this direction presupposes the use of modern machinery and standard materials, tools, and accessories in com-



COMPOSING ROOM, PRINTSHOP, OAKLAND PUBLIC SCHOOLS, OAKLAND, CALIF.

mon use in the practice of the trade. For those students who thus early elect printing, hand composition, command of English, simple job work, and platen-press feeding should be emphasized. The equipment in the printshops in Oakland junior high schools has been standardized, and is such as to conform to the above ideas. The success of printing in schools depends upon a thorough and systematic direction of the student's development. The work must be taken up in its logical order and so diversified as to afford all possible experiences. Instruction must utilize all the means afforded by

each process and operation in demonstrating the practical application of principles.

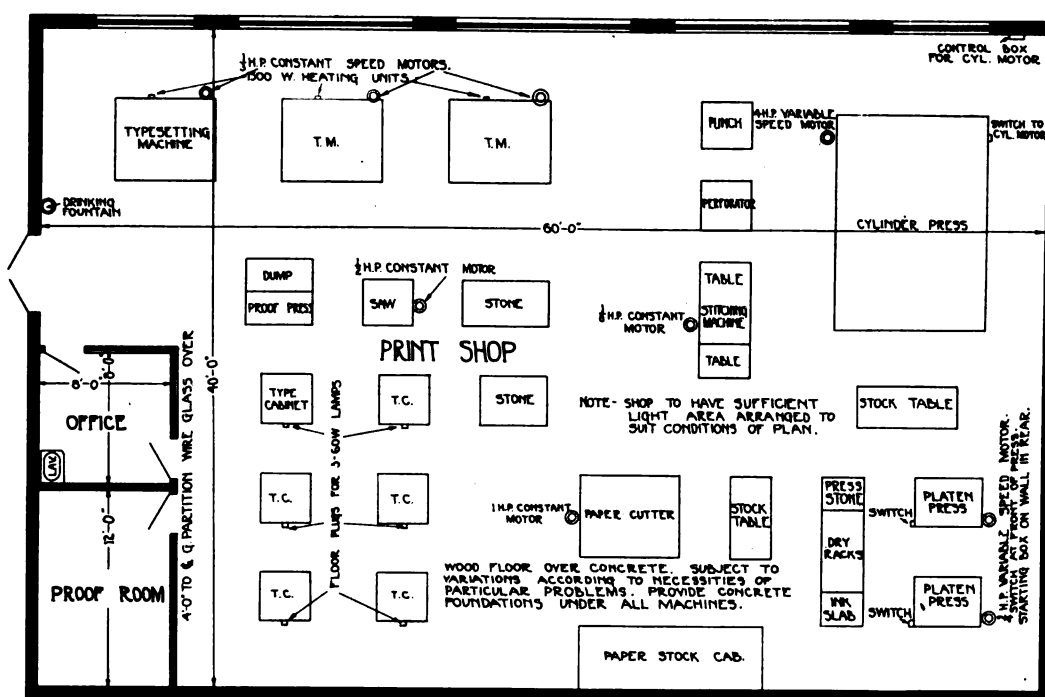
Other objectives that we are working toward are:

1. To provide experiences which will show the practical application and value of academic subjects, especially language.
2. To develop a pride in personal achievement.
3. To cultivate an appreciation of the value of cooperation and service.
4. To develop an appreciation of good printing.
5. To help in forming habits of accuracy, thoroughness, neatness, industry, and correct use of language in speech and printed form.

The work done in the printing classes is taught by means of subdivisions of the following general headings:

1. *Composing Room*
 - a) Lay of case
 - b) Preliminary type-setting
 - c) Study of type
 - d) Point system
 - e) Correcting proof
 - f) Locking up
 - g) Distribution
 - h) Setting jobs
 - i) Simple head setting
 - j) Newspaper make-up.
 - k) Page make-up, booklet and magazine
 - l) Imposing
2. *Presswork*
 - a) Fundamentals of letter-press work
 - b) Demonstration of working parts of platen press
 - c) Feeding the platen press
 - d) Bindery work

In the beginning classes, shop talks are given explaining the technique of typesetting, the use of



PRESSROOM, PRINTSHOP, OAKLAND PUBLIC SCHOOLS, OAKLAND, CALIF.

language as a tool, the size of spacing material, the point system, etc. These talks are short, the aim being to cover only one point in each. The shop talk is followed by some job, or exercise, that demonstrates the matter covered in the talk. In the more advanced classes, technical matters are taken up with the students at the time they are handling jobs involving need for such information. As an example, technical knowledge of page make-up, form layout, margins, etc., are taken up at the time these operations are being used in printing a book or a newspaper.

The opportunities of employment in the printing industry, wages, conditions of work, opportunities for advancement, etc., are also the subjects of shop talks.

Instruction sheets are used throughout the course in printing, because practically all content material and operations in the junior-high-school grades can best be taught by this means.

Electric Shop

In the junior high school, electrical work is treated entirely as a prevocational or a course-finding subject. Elementary instruction is given in regard to batteries, bells, wire, magnets and magnetism, electric lights, motors, generators, chargers, telegraphy, telephony, transformers, high-tension currents, radio, auto electricity, plating, and electric apparatus in general. The course may cover two years of work. Each boy usually makes a small solenoid-type motor, and in the ninth year some elementary piece of apparatus is built by the group and left in the shop for instructional purposes.

All the Oakland high schools are of the cosmopolitan type, for we have no strictly technical schools. In these schools, we endeavor to provide shop training of different types for any student who may wish to take it. Shop equipment is very expensive, and for that reason all schools are not equipped with the same types of shops; for example, not all of the schools have machine shops. If a boy desires to do work which is not given in his school, he is allowed to transfer to one in which the desired subject is taught.

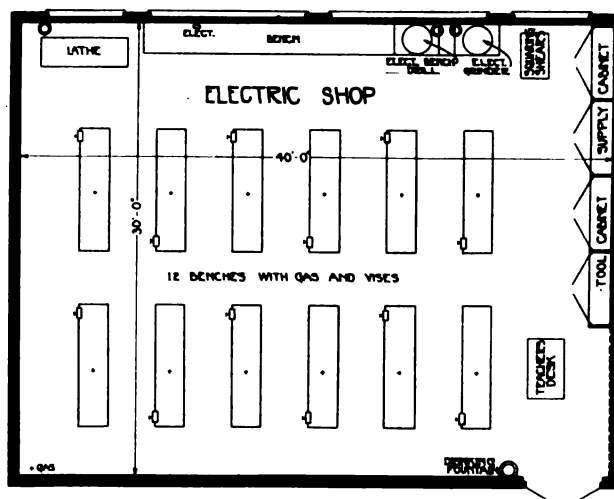
The industrial-arts work in the high schools is planned:



COMPOSING ROOM, PRINTSHOP, McCLYMOND HIGH SCHOOL, OAKLAND, CALIF.



PRESSROOM, McCLYMOND HIGH SCHOOL, OAKLAND, CALIF.



ELECTRIC SHOP, OAKLAND PUBLIC SCHOOLS, OAKLAND, CALIF.

1. To provide exploratory courses, to discover interests, and reveal possibilities.
2. To provide general industrial experiences of common value to all students.

3. To provide training for the student needing a combination of academic and industrial education.

4. To provide technical training auxiliary to a chosen trade or profession.

Students taking a general high-school course and desiring shop-work can take up any line of work that is given in the schools. They are not required to go into trade classes. In order for schools to function as they should in any community, they must provide training for all the children of all the people. There is a large group of young people in every community that must work with their hands, and Oakland feels that she would fall short of doing her duty to these youths, did she not provide for their training so they could enter into advantageous employment and be an asset rather than a liability to the employer.

In four of our high schools we are providing opportunities for trade training. All-day vocational classes are held in millwork, machine shop, auto repair, patternmaking, electric work, sheet metal, forging and welding, printing, and chef cooking.

The following gives a brief outline of what we are doing.



ELECTRIC SHOP, ROOSEVELT HIGH SCHOOL, OAKLAND, CALIF.

Auto Repair

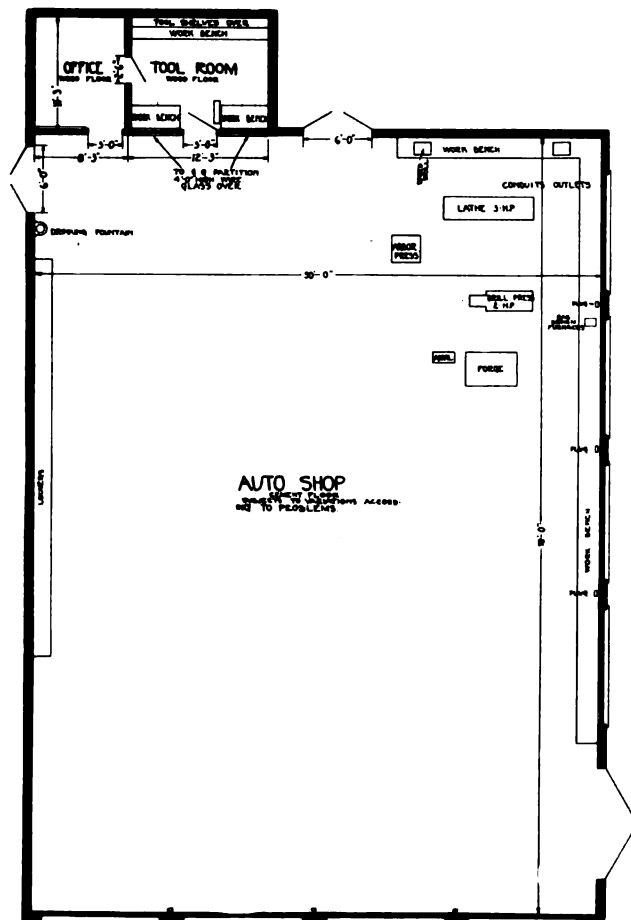
The course is organized to give the student a general and not a specialized training. He does his work on actual repair jobs on modern automobiles, using the same tools, equipment, and shop practices that the up-to-date shop uses. Shop talks and demonstrations are given in order to teach the functions of the various parts and the material used in their manufacture. Special emphasis is placed on accuracy of fitting, and extreme care in locking all parts securely.

The following groupings are used as the basis for teaching:

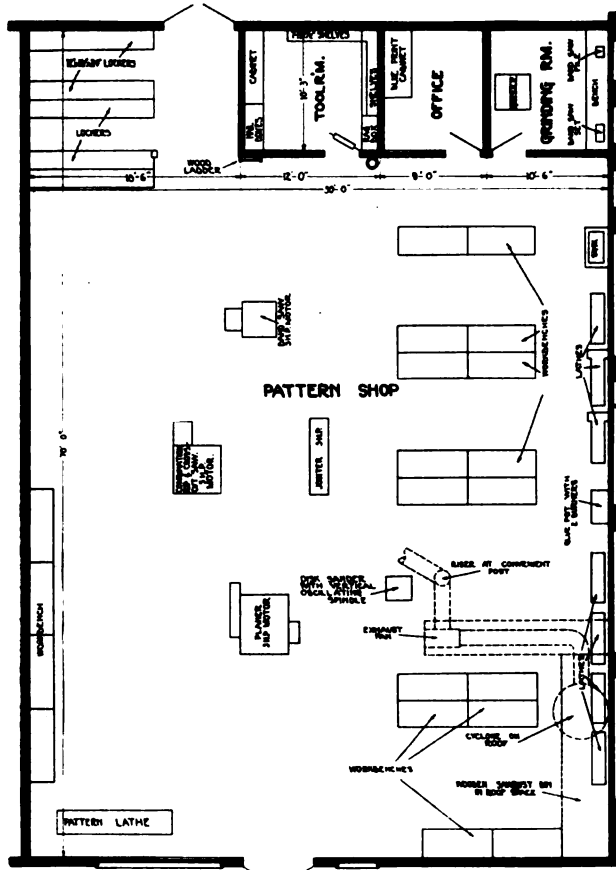
- I. *Running Gear and Body*
 1. Tires and Tubes
 2. Springs
 3. Brakes
 4. Wheels
 5. Frame
 6. Front Axle
 7. Snubbers
 8. Fenders and Body
- II. *Power Transmission and Control*
 1. Universal Joint
 2. Rear Axle
 3. Steering Mechanism
 4. Clutch
- III. *Power Generation*
 1. Cooling System
 2. Lubrication
 3. Fuel System
 4. Engine
- IV. *Electrical Systems*
 1. Lighting System
 2. Ignition System
 3. Battery
 4. Starting System
 5. Generator

Millwork

The course carries the student through the experience of hand and machine manipulations, working from the simple to the complex jobs. This involves the care and proper use of the bench tools, band saw, surfacer, rip and crosscut saw, jointer, mortiser, tenoner, and shaper. The boy is taught the reading of blue prints and the ability to make the layout rod and board from print or drawing. All work done is on real jobs, and everything is based on factory production methods.



AUTO SHOP, OAKLAND PUBLIC SCHOOLS, OAKLAND, CALIF.



PATTERN SHOP, OAKLAND PUBLIC SCHOOLS, OAKLAND, CALIF.

Patternmaking

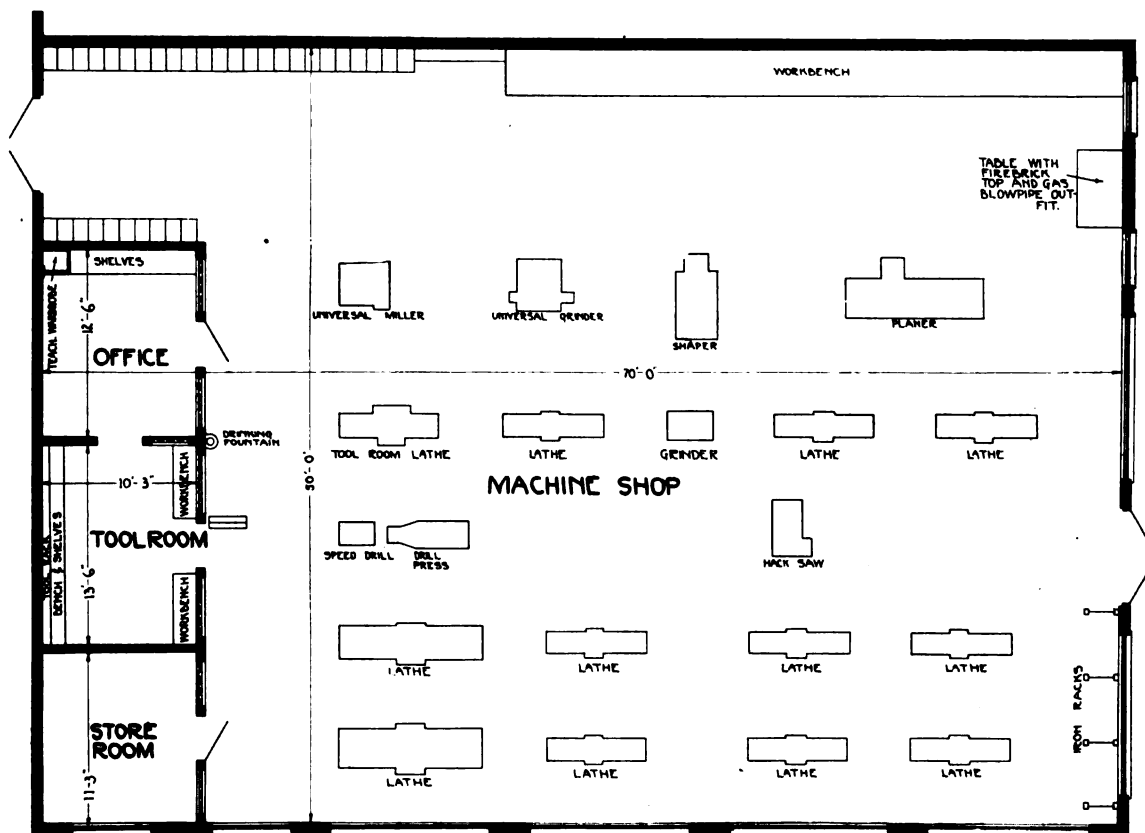
In this subject we give a three years' course and carry the boy through different hand and machine

manipulations, working from the simple to the hardest jobs. By means of shop talks and demonstrations, he is taught the molding fundamentals, allowances for shrinkage, layouts, selection of lumber for the job, the use of abrasives, fastenings, shellac, fillers, and fillets. He is given simple type jobs and those involving segmental construction, wheels with webs and arms, pipe construction, core-box construction and simple right- and left-hand patterns. The student is carried along gradually, until in the latter part of his course he is given experiences involving complicated core work; special pattern work involving complicated types of construction; gear work, propeller work and match platework. In order to make this class of patterns, he must have acquired a fair knowledge of shop mathematics, geometrical problems, coremaking, molding fundamentals, properties of stock, and the reading of blue prints, and be able to make accurate layouts.

Machine Shop

In this work the student is taken through the fundamental principles of machine-shop work, and thus lays the foundation to become a competent mechanic. The equipment is complete, and the student gains experience which cannot be duplicated even in some machine shops.

Training is given on the following machines: lathe, hack saw, drill press, vertical and horizontal boring mill, radial drill, shaper, planer, universal and plain miller, vertical miller, slotter, plain and



MACHINE SHOP, OAKLAND PUBLIC SCHOOLS, OAKLAND, CALIF.

universal grinder. The boy is taught tool grinding, tempering, tool and die making, the use of the dividing head, and compound indexing. He is given all-around training as a machinist so he will be an asset to his employer.

Electrical Work

It is the purpose of this course to give the student a thorough training, whereby he can enter and intelligently take part in the affairs of the electrical craft. The work in this course consists of four units which, when taught together, comprise a three- or four-year high-school course. Any unit may be taught separately as a specific branch of the electrical trade. These four units are:

I. Signal Wiring

- a) Bell and annunciator wiring.
- b) Telephone wiring.

II. Power Maintenance

- a) House wiring.
- b) Power circuit wiring.

III. Rewinding Department—Electrical Machinery

IV. Lead-Storage-Battery Repair

In teaching the content material of these units, progress should be made according to a definite plan, in order that the student may advance according to the learning difficulties of the trade.

1. He should be grounded in the basic principles of the particular unit of the trade which he is taking up, in order that he may proceed intelligently on his first electrical job.

2. He should be given jobs that show the use of the electricians tools for both simple and complex operations.

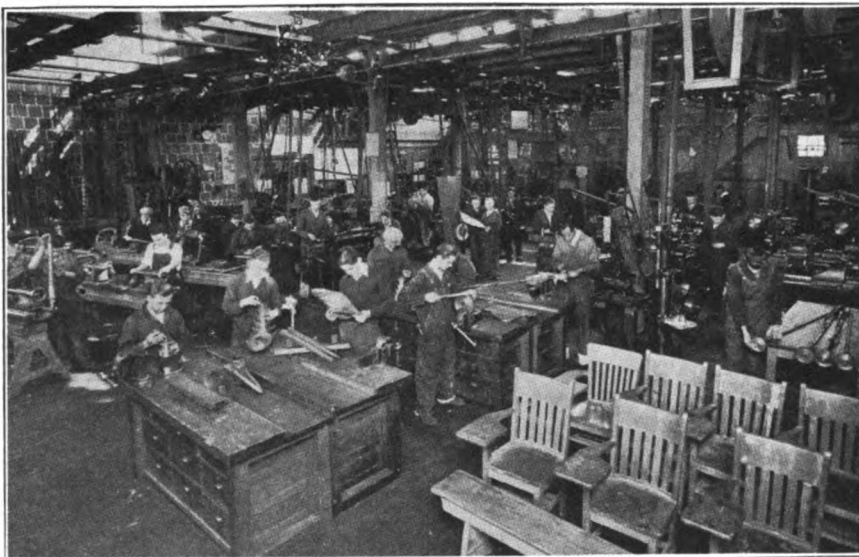
3. He should be given the installation methods of the parts of the electrical equipment of that unit.

4. He should then be given specifications and placed on his own initiative, the requirements being that the job must pass the same inspection as those required by the trade.

Safety first and first aid are an important part of the course and the workman's code of honor is thoroughly impressed on the student. Job sheets are used throughout as an aid to the instructor.

Sheet Metal

The trade course in sheet metal affords the opportunity for boys to become acquainted with, and more or less skillful in the fundamental processes and principles of the vocation. It is two years in length, the first year being used to lay the foundation and thoroughly establish the basic principles and processes. The second year is given to prob-



MACHINE SHOP, McCLYMOND HIGH SCHOOL, OAKLAND, CALIF.

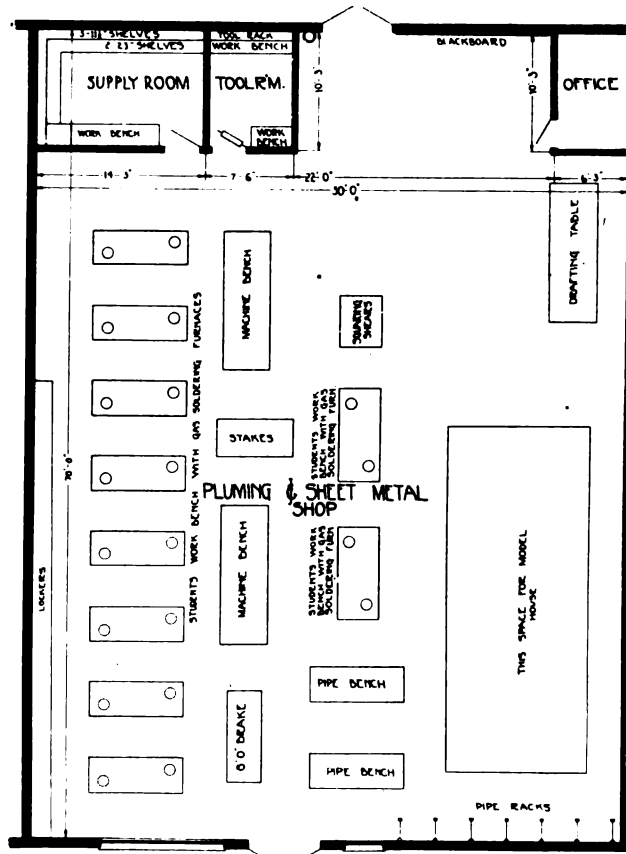
lems that arise in the building-trade work. The following problems illustrate the work done:

1. *Gutter Work*: Square return miter—butt miter, oblique in elevation.

2. *Round Pipe Work*: T joints, 45 degree and 90 degree elbows, roof flanges, ventilator heads.

3. *Leader Work*: Outlet tube, offset, foot piece, leader head.

4. *Ventilator Work*. Range canopy, transition piece, square pipe elbow, Y joint, ventilating head.



PLUMBING AND SHEET-METAL SHOP, OAKLAND PUBLIC SCHOOLS, OAKLAND, CALIF.

The last ten weeks of the course is given to the method of triangulation and its applications. All students are required to develop their own patterns.

A Course for Chefs

This course is designed to give the boys a two year's training in the fundamentals of cooking, which will enable them to hold positions as assistant cooks in almost any place where cooks are found. The equipment used is complete and of the best and most modern type. The class organization is based on actual conditions as found in hotels and restaurants in this locality. The work is to prepare the students as: (1) vegetable cook and kitchen helper, (2) hot cake, waffle, and toast man, (3) pantry man, (4) butcher, (5) baker, (6) pastry chef, (7) cold-meat chef, (8) fry cook, (9) roast cook, (10) second cook, 11 chef.

The boy who rates the highest on his work card becomes chef; the next, second cook, and so on down to the helper. The cards are rerated each week giving opportunity for a boy, who may have been helper, to become chef the following week. Training is given along all the lines suggested by the different positions above, including the responsibilities and requirements of each position.

Mechanical Drawing

The beginners in this subject take up lettering, linework, tangents, geometrical problems, and orthographic projection. The second part is largely a course in intersections of planes and solids. The third part is architectural and embraces building details and specifications and includes designing and drawing the complete plans of a bungalow and two-story house or an apartment house. Then comes machine design with details of small parts, drawing a lathe, or a shaper, and includes the designing of a complete machine.

The related drawing for vocational classes, as the name implies, is closely related to a given shop or trade, and the information should carry over into the practical work. The training given, leads to quick, accurate observation and gives the power to read description from lines, and also gives the student the opportunity to exercise his ability to interpret his impressions, and visualize objects shown on drawings clearly.

Printing

The course in printing is four years in length, and is intended to give a student training in all the operations of the printing plant and enable him to become proficient in at least one of the different lines, such as hand composition, linotype, or monotype operation, presswork, and proofreading. All training is on an individual basis, but shop talks are given to groups. Classes are organized along trade-plant lines with two student foremen, one in the composing room and one in the pressroom. The

equipment is such as would be found in a high-class printshop and is very complete.

In the equipment are monotype, linotype, and Ludlow machines, cylinder presses, platen presses (both foot power and motor driven), paper cutter, stitcher, punch, perforator, and folding machines. Students are alternated periodically between work in the composing room and the pressroom, entering students being first assigned to the composing room.

The work done lends itself to instruction and the flow is controlled in such a way as to make for the maximum efficiency in that direction.

Evening trade-extension classes are held in nearly all the subjects that are taught in the daytime shops. These classes are for adults and restricted to those directly connected with the trade with which the course deals. The courses are divided into short units, and a person can take one or more units.

Classes in all types of work are also held for adults who may not be following the particular trade, but who wish to take the work for their own pleasure or profit.

The Central Trade School is maintained for the purpose of offering training for entrance into occupations and to carry on training for those who are already employed, either as apprentices or as adult workers. There are three main divisions of vocational work in the program of this school.

1. Preemployment program, which gives four hours daily in trade for which training is offered. This means that a boy goes into a class, puts in 20 hours per week, and remains there until he is employed.

2. Apprentice-training program, which provides part-time day classes for employed boys, so they may progress in their chosen employment.

3. Trade-extension program, which provides special day and evening classes for adult workers, who seek special help in the occupation they are following.

In this school, training is given for all the above groups in carpentry, plumbing, painting and decorating, millwork, sheet metal, electricity, machine shop, welding, radio, telegraphy, radio repair and maintenance, cleaning and pressing, cosmetology, dressmaking, and printing.

In addition to the above, evening trade-extension work is given in roof framing, mill estimating, structural steel, construction drawing, graining and marbleizing, ornamental plastering, electric estimating and plan reading, meat cutting and merchandizing, plan reading, and mechanical drawing.

Courses in plumbing, painting and decorating, radio telegraphy and radio repair, welding, cleaning and pressing, and cosmetology are not given in other schools. An outline of the type of work given in these subjects follows:

Plumbing

The work done consists of the installation of standard bathroom, kitchen and laundry plumbing, all work being required to stand the regular commercial tests. The study and repair of water heaters, fixtures, etc., is thoroughly taken up.

Painting and Decorating

Painting, tinting, paperhanging, stenciling, and all branches of the painting trade are thoroughly practiced. The preparation of wall surfaces, the treating of painted surfaces, the cutting of stencils, the mixing of paint, the matching of colors, etc., are given particular attention. The science of paint and its properties, the drawing of designs, the study of color and design, the estimating and listing of materials are all taken up in detail.

Radio Telegraphy and Radio Repair

In this shop there is a complete equipment, such as is found on ships, for the training of radio operators, and enough telegraphy keys so that each student can practice receiving and sending the international code. The course prepares the student for taking the federal examination for commercial operators. In the radio-repair course, all work is practical, the actual assembling, disassembling, and repairing of sets being required. Along with the practical work the theoretical side of radio is given.

Welding

Both electric-arc and oxyacetylene welding are taught in this school. This shop is equipped with the finest equipment manufactured and the manipulative and technical instruction is directly in line with the demands of industry. Special attention is given to safety factors. The chemistry and met-

allurgy of fusion welds present an opportunity for the technically inclined student to enter a field of industry which is practically new and expanding rapidly.

Cleaning and Pressing

The course in fancy spotting takes up the study of fabrics, the chemical reaction of different cleaning solvents, and the practice of proper processes of doing the job.

Fancy pressing takes up the pleating and pressing of all sorts of heavy and delicate garments. The knowledge of the proper care of ornamental buttons and trimming must be acquired by fancy pressers.

The dyeing of garments, the dry cleaning of suits and dresses, the marking, sorting, washing, and mending of all sorts of outer garments, is taken up in detail.

The plant is equipped with modern appliances and the pupils practice on actual garments.

Cosmetology

In this class, manicuring, permanent waving, marceling, facial massages, shampooing, hair waving, hair dyeing and the care of the skin, nails, and hair are given in such a practical and thorough manner that graduates can pass the state examination and may enter the commercial shop and ply their trade.

Special lessons in physiology, hygiene, and the scientific aspects of the work, such as the treatment of the skin and hair, are required by state regulations and given in this school.

The beauty shop is well equipped and beautifully arranged to care for the many patrons who come daily to have their work done.

Industrial-Arts in a City of 500,000

Elmer W. Christy, Director of Industrial Arts, Cincinnati, Ohio

"It is a good thing for a pupil to be able to work with his hands; to be 'handy with tools'; to experience the satisfaction that comes from making something; to be able to express himself in material form; to measure himself and his accomplishments with standards that tell the exact truth; to know from experience what it is to perform manual labor, and so have more sympathy with those who work. The purpose of industrial-arts work is to give an all-round training; to make a pupil resourceful, inventive, creative. To do this, however, it must make a strong appeal to the pupil; it must have motive; it must not confine itself to school exercises; it must relate itself to a variety of processes; it must deal with a variety of materials; it must be connected with live problems; it must concern itself with the interests of the home, the school, and the community from the point of view of making and doing. I believe, too, that it may become much of a prevocational course, revealing to pupils their interests and aptitudes, without losing any of its other educational values—in fact, this should give an added value."—*Randall J. Condon, Superintendent, (1915).*

Cincinnati did not introduce manual training into its school system until 1905. The first definitely

organized shopwork was started at that time under the supervision of the late Frank H. Ball. Previous to 1912, at which time Mr. Ball went to Pittsburgh, and the present writer was charged with the responsibility of directing the manual-training department, two significant experiments had been started; namely, the apprentice continuation school, and the technical cooperative high-school course. Both of these experiments have since been discontinued, their functions having been absorbed by the more recently organized vocational-education department, in which have been incorporated all classes coming under Smith-Hughes control. Practically all of these Smith-Hughes classes are housed in buildings of their own, independent of regular elementary or high schools.

At present the industrial-arts department includes all shopwork and mechanical drawing in

grades five, six, seven, and eight, as well as in junior and senior high schools. One director and 83 teachers are employed. With this explanation or background, I shall attempt to review the development of the work during the past 17 years.



FIG. 1. OYLER SCHOOL SHOP IN 1914, CINCINNATI, OHIO

In 1912 woodwork and mechanical drawing, both of a very formal type and allowing very little deviation from a prescribed list of problems, comprised the shopwork in elementary schools. In the high schools we had a course which was just as formal, consisting largely of exercises in cabinetmaking in the first year, wood turning and forging in the second year, patternmaking and foundry in the third year, and machine-shop practice in the fourth year, with mechanical drawing ninety minutes per week throughout the four years. Such programs could be found in many high schools throughout the country at that time.

In the fall of 1912, teachers of industrial arts in elementary schools were asked to consider other materials than wood with which to work. As a result, several efforts were made to give breadth to school-shop experiences. The best known of these was developed by Mr. Ray F. Kuns in our Oylar School, were projects of wood and metal, as well as concrete, all involving original design, special construction, use of jigs, a cooperative organization, quantity production, boy foremen, and other innovations frequently discussed in current literature, found their place. Other centers on a smaller scale were started at the same time, and until absorbed by junior-high-school organizations, all have continued to serve their purpose by enriching the program of industrial-arts experiences.

Thus, we find that some of the first general shops in the United States were located in Cincinnati, but we should also note this significant fact; they were able

to flourish only where principals were willing to disregard the traditional program of sixty to ninety minutes per week for shopwork, and provide three or four times as much. It is worthy of note, also, that boys who went to these schools were able to carry on successfully in senior high schools, although they had devoted less time in the elementary schools to academic subjects, because of the increased shop time. It was just this kind of experience which caused some of us to believe that there are many who learn most readily, even the traditional school subjects, with the help of motivated manipulation applied to tools and materials. The observation of these experiments led superintendent Condon to write the definition of industrial arts which appears at the head of this review.

As we proceeded, it was observed also that in giving breadth to the shop course we had to incorporate the tools and processes of industry, not for definite trade-training, but because they were necessary to carry out the projects which boys like to undertake; hence, the change in the name of the department from manual training, to industrial arts, and the adoption of a course of study based on the interests of boys involving tools and materials as the circumstances demanded. Thus, there has grown up a system, in no two schools of which will you find the same projects under way, although on the whole a common core of interests directs all boy activities.

In the high schools, similar changes have taken place. Wood turning and forging as special subjects have given way to sheet-metal work and electricity, thus keeping pace with the changing interests and practices of our times, and we must expect other activities in turn to take their place, in fact, airplane building is already making its demands for attention.

Printing

Printing entered our schools as an industrial-arts subject as part of general education, and has grown to rather large proportions. It makes a strong ap-



FIG. 2. FORGE SHOP IN 1913, WOODWARD HIGH SCHOOL, CINCINNATI, OHIO



FIG. 3. INDUSTRIAL-ARTS SHOP, SAYLOR PARK EIGHT GRADE SCHOOL, CINCINNATI, OHIO

peal to many boys. Aside from its social values and its economic contribution to school operation through the printing of school forms, papers, etc., it provides opportunity for exploring one of our greatest industries.

The development of junior high schools has had a stimulating effect on industrial arts since the common practice is to increase the time devoted to shopwork. We have discovered also that such subjects as machine-shop practice are just as interesting to eighth and ninth-grade boys as to older ones.

In the development of a junior high school, Cincinnati has moved slowly, and there are still many more pupils in our seventh and eighth grades of elementary schools than there are in junior high

schools. In planning the junior high schools which have been built, liberal provision has been made for shops. On the whole, these shops are sufficiently large to permit boys to undertake problems of considerable magnitude, and the equipment has been selected with reference to its fitness for practical working conditions. Experience indicates that standard equipment for commercial shops generally meets the best needs of school shops, where inexperienced pupils are apt to subject it to unusual demands or abuse.

This statement is not intended to undervalue small machines if they are sturdily built and will meet constant and heavy demands within the limits of their capacity. It is very interesting to note that an increasing number of manufacturers are recognizing these conditions.

Our program for industrial arts provides for one sixty-minute period per week for fifth and sixth grades, and one ninety-minute period per week for seventh and eighth grades. One of our new installations in this type of school is illustrated in Figures 3 and 4. That it is equipped primarily for woodworking is evident, but provisions for simple projects in electric wiring, soldering, sheet-metal work, and other activities is made on the long bench, located against one wall. Tools are kept in a toolroom, lumber is stored on end in pipe-frame racks, and unfinished projects in conveniently located lockers. The benches, with maple tops made of strips glued together, and mounted on frames made of $1\frac{1}{4}$ inch pipe, were made in our Washington Junior High School. Each bench is provided with a swinging seat mounted on the frame, and a plain screw vise, both of which attachments were also made by boys in the above school. A wood-turning lathe is also provided.

In our junior high school, the periods are 45 minutes long. In the seventh grade, all boys spend six periods per week in the shops, rotating through four activities; in the eighth grade four periods of shopwork are required, and three more elective; in the ninth grade four periods are required, and four more elective. In our newest secondary school, a 6-year high school, the periods are 60 minutes long. In the seventh and eighth grades, boys spend one period per day in shop or mechanical drawing; certain elections in the ninth grade provide eight, four, or two periods respectively. Beyond the ninth grade all shopwork is elective.

In this new school we have provided two general woodwork shops; one general metal-work shop, to include sheet-metal and machine-tool work; one electrical shop; one printshop; and two mechanical drawing rooms.

All shops were planned to accommodate 28 pu-

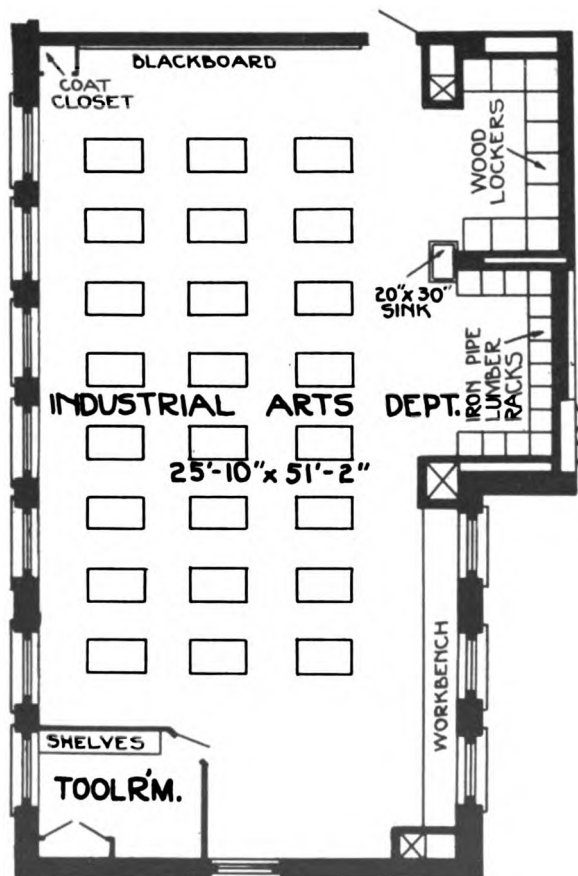


FIG. 4. WESTERN HILLS HIGH SCHOOL, CINCINNATI, OHIO

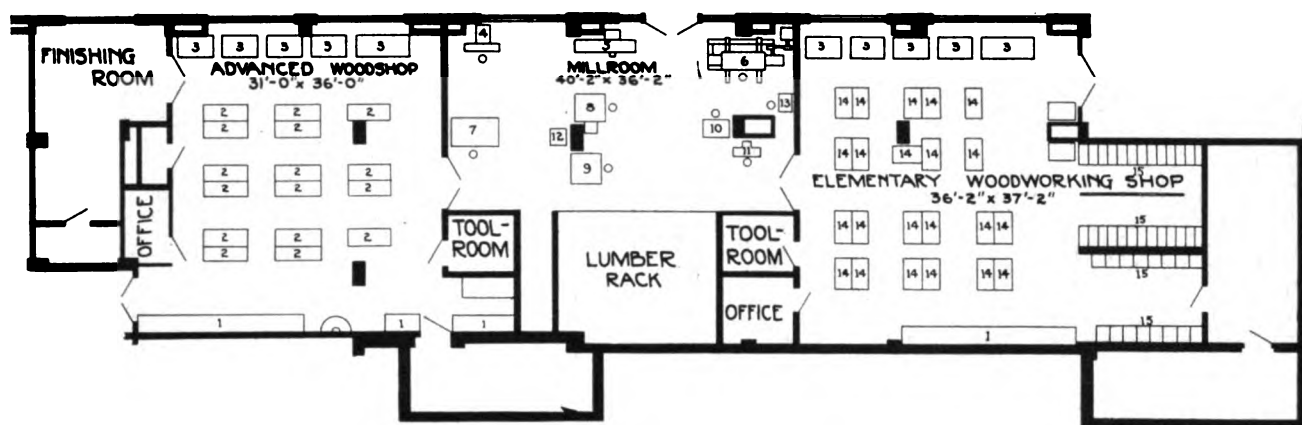


FIG. 5. WESTERN HILLS HIGH SCHOOL, CINCINNATI, OHIO

- | | | | |
|---------------|------------------|---------------------|----------------------|
| 1. Wall Bench | 5. 12" Jointer | 9. 14" Circular Saw | 13. 12" Disk Sander |
| 2. 5' Benches | 6. Belt Sander | 10. 20" Band Saw | 14. 24"x 42" Benches |
| 3. 12" Lathes | 7. 36" Band Saw | 11. 6" Jointer | 15. Lockers |
| 4. Mortiser | 8. 24" Surfacers | 12. Tool Grinder | |

pils. In each of the woodwork shops, five lathes must be included in order to provide sufficient stations. By rotating groups, about one-fourth of the time given to woodwork may be spent at a lathe. The woodworking machines are grouped between the bench rooms, and separated from them by glass partitions. Ample storage space for lumber and unfinished projects is provided, as well as a finishing room, where spraying apparatus will soon be installed. Plans for new schools will hereafter include definite provisions for this modern method of finishing. Figure 5 shows the Western Hills High School woodworking department.

The electrical shop contains wiring booths for practical house wiring, and large workbenches provided with swinging seats. These benches are located in front of the blackboard, the instructor's demonstration bench, and the distribution panels. The latter were built in our Washington Junior High School, and provide on each of four benches a large range of voltages in both alternating and direct current. A small engine lathe provides opportunity for coil winding, and also the making of small metal parts independent of the metal-working shop. Ample storage space for tools and material is provided, as well as a teacher's desk room. A wash fountain also is provided. Figures 6 and 7 show the electrical shop of the Western Hills High School.

The printshop, with its type cases near the windows and its large tables with swinging seats before the blackboard, has proved quite satisfactory. For classes of thirty pupils, however, the room should be somewhat larger even in junior high schools. It may be necessary to materially reduce the size of the stockroom, to provide additional working space. The three job presses are continuously

in use. Figures 8 and 9 show the printshop in the Western Hills High School.

The general metal-work shop is planned to accommodate two classes. It is quite crowded though when both classes reach 28 or 30. The major units provided for are sheet-metal work, and machine-tool operation, but two forges and pipe-

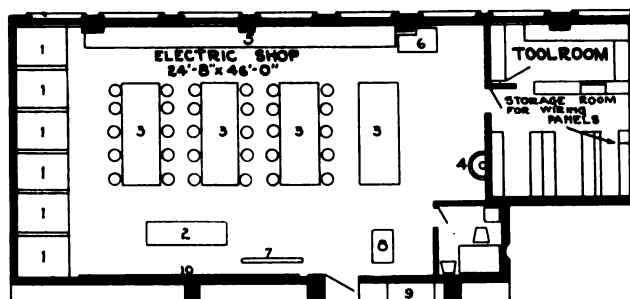


FIG. 6. WESTERN HILLS HIGH SCHOOL, CINCINNATI, OHIO

- | | |
|-------------------------------|----------------------------------------|
| 1. Wiring Booths | 7. Switchboard |
| 2. Demonstration Bench | 8. Motor Generator |
| 3. 4' x 10' Bench with Stools | 9. Switchboard for D. C. Distribution. |
| 4. Wash Fountain | 10. Blackboard |
| 5. Wall Bench | |
| 6. 11"x 4' Lathe | |

threading tools are also included. This equipment contrasts sharply with the forge shop of fifteen years ago which is shown in Figure 2. Figure 10 shows the layout of the present general metal-work shop of the Western Hills High School, and Figure



FIG. 7. ELECTRIC SHOP, WESTERN HILLS HIGH SCHOOL, CINCINNATI, OHIO

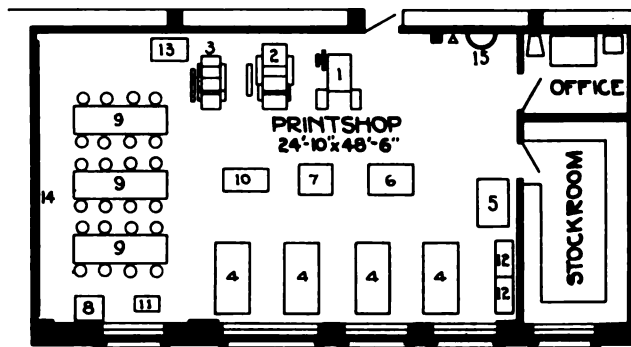


FIG. 8. WESTERN HILLS HIGH SCHOOL, CINCINNATI, OHIO

- | | |
|----------------------------|---------------------------|
| 1. 10x15 Platen Press | 8. Drying Rack |
| 2. 12x18 Platen Press | 9. 2'6"x 8' Tables |
| 3. 8x12 Platen Press | 10. Proof Press and Stand |
| 4. Double-Tier Case Stands | 11. Wire Stapler |
| 5. 26" Lever Paper Cutter | 12. Galley Racks |
| 6. Imposing Table | 13. Chase Rack |
| 7. Pressroom Cabinet | 14. Blackboard |

11 shows a view of that portion of the shop which is devoted to sheet-metal work.

Two mechanical-drawing rooms, one of which is shown in Figure 12, with a desk room and blue-print room between them complete the industrial-arts equipment in this six-year high school. The drawing tables were built by the industrial-arts department and represent a very sturdy, compact, and convenient arrangement for drawing purposes. One of them is shown in Figure 13.

Industrial-Arts in the Senior High School

In our senior high school, boys may elect the industrial-arts course in the ninth grade, and for four years devote eight 45-minute periods per week to



FIG. 9. PRINTSHOP, WESTERN HILLS HIGH SCHOOL, CINCINNATI, OHIO

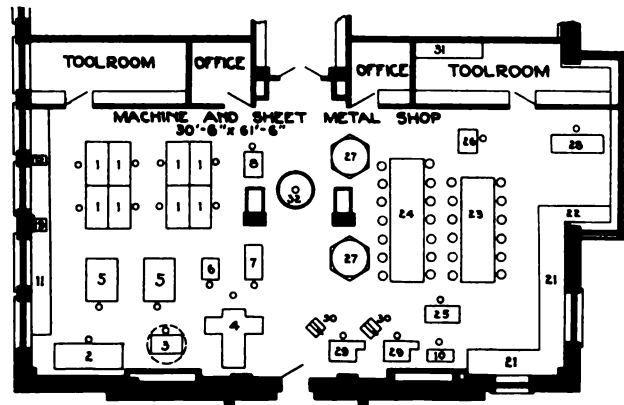


FIG. 10. WESTERN HILLS HIGH SCHOOL, CINCINNATI, OHIO

- | | | |
|--------------------|--------------------------|----------------------|
| 1. 11" Lathes | 9. Bench Grinder | 25. Forming Rolls |
| 2. 16" Lathes | 10. 12" Double Grinder | 26. Squaring Shears |
| 3. Cutter Grinder | 11. Wall Bench | 27. Machine Bench |
| 4. Milling Machine | 12. Arbor Press | 28. Cornice Brake |
| 5. 16" Shaper | 21. Soldering Bench | 29. Forges |
| 6. Sensitive Drill | 22. Vise Bench | 30. Anvils |
| 7. 20" Drill | 23. Bench Layout 4'x 12' | 31. Sheet-Metal Rack |
| 8. Power Hack Saw | 24. Bench 4'x 14' | 32. Wash Fountain |

shopwork, and two periods to mechanical drawing. The program provides for cabinetmaking and wood turning in the ninth grade, sheet-metal work and forging in the tenth grade, patternmaking and foundry in the eleventh grade, and machine-shop prac-

tice in the twelfth grade. A two-year course in printing or in electricity may be substituted in the ninth and tenth grades, followed by a choice of subjects in the eleventh and twelfth grades. The trend is decidedly toward greater freedom in the choice of subjects, and a consequent breaking down of the old idea of subject sequence.

The shops of our senior high schools are equipped throughout with standard machines, capable of continuous use in large-quantity production, a test to which they are often subjected. A number of changes which have been made in our original program include the elimination of wood turning as an isolated course, and its incorporation with cabinetmaking or general woodwork. The same is true of forging, which formerly occupied

a complete shop with 36 forges, and is now part of a general metal-work course, requiring about six forges. Our tendency is to gradually develop general-unit shops, such as referred to above, so arranged that they may be used by both junior and senior high school pupils.

Provision for a general shop is shown in the plans (Fig. 14) which have just been completed for our new Western Hills High School. This school invites into its seventh grade, pupils who plan to prepare intensively for some professional career, and who, because of language elections, do not have enough time for the usual shop course. We plan here to have a printshop, a mechanical-drawing room, and a general wood and metal shop. Our justification for this innovation is based on observation of similar schools in other cities where a limited amount of shopwork is proving both popular and profitable, as a relief from too much book study.

The Washington Junior High School

A review of the industrial-arts department in Cincinnati would not be complete without special reference to our Washington Junior High School, an industrial school, operated independently of the

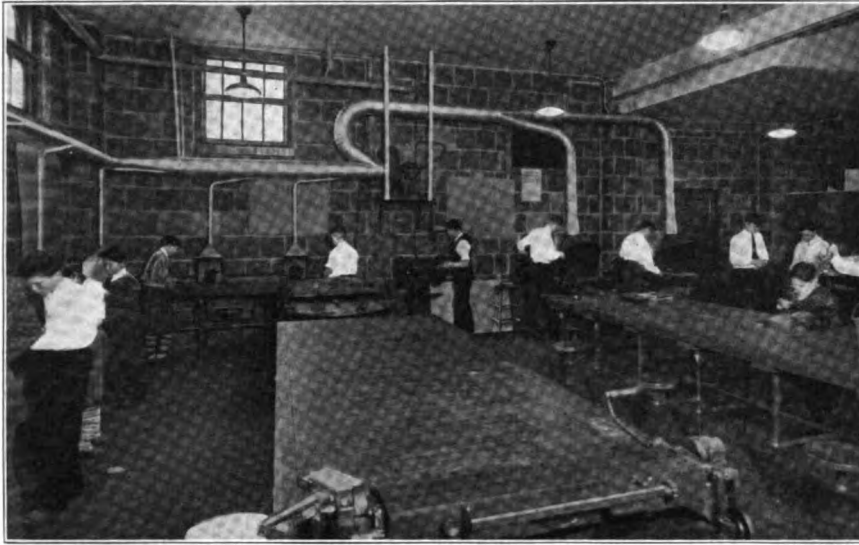


FIG. 11. GENERAL METAL SHOP (MACHINE TOOLS NOT SHOWN), WESTERN HILLS HIGH SCHOOL, CINCINNATI, OHIO

Smith-Hughes organization. In this school, boys spend one half of each day in some one of the shops. Entering in the seventh grade with the understanding that they are not senior high school probab-

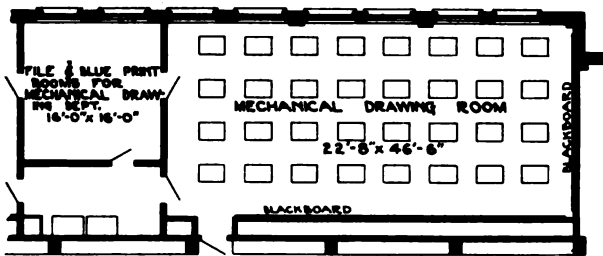


FIG. 12. WESTERN HILLS HIGH SCHOOL, CINCINNATI, OHIO

ities, the first year is devoted to exploration, after which they elect a specific trade, for which they wish to prepare. This school is located in a factory building, providing 30,000 feet of floor space. It has attracted the attention and favorable criticism of many visitors, because of the pride which the boys show in maintaining a high standard of workmanship. Practically all of the products are on orders for equipment and supplies for use in some part of the school system; the boys make practically nothing for themselves as individuals. Here we have our largest and most completely equipped wood-work shop, with space for 50 or 60 boys. Similar provisions are made for electrical work, printing, and sheet-metal work, and courses in automobile work and machine-shop practice are being developed. Mechanical drawing and architectural drawing are taught parallel to the shopwork. It is in this school that much of our school equipment is manufactured.

Having finished the regular course at the end of the ninth grade, boys often come back for the tenth grade because they like to work in these shops, although they provide neither wages nor a coopera-

tive arrangement with industry. As positions open, these boys finally leave to go directly into the respective trades where they have always been welcome, and where their practical training in school, including theory as well as practice, has enabled them to progress rapidly to responsible positions. While boys enter this school with the avowed purpose of preparing for some trade, nevertheless, one who decides at the end of the eighth grade to go to senior high school can do so without great loss.

The problem of an architect in planning a modern school building is a complicated one, in which the size and location of shops is

just one item; the result, therefore, is often a compromise. The most common practice is to locate shops on the ground floor, and in many cases this is quite satisfactory, if certain provisions are made. In the first place, the rooms must be dry and well lighted, even though it requires waterproofed walls and floors. Then daylight should be provided even in excess of that provided for classrooms, because close measurements require good light. Artificial light should also be provided in excess of twelve-foot candles.

Obviously, school-shop planners have not reached the position where standard plans are recognized. An arrangement by one person is rejected by another, yet each may seemingly justify his position.



FIG. 13

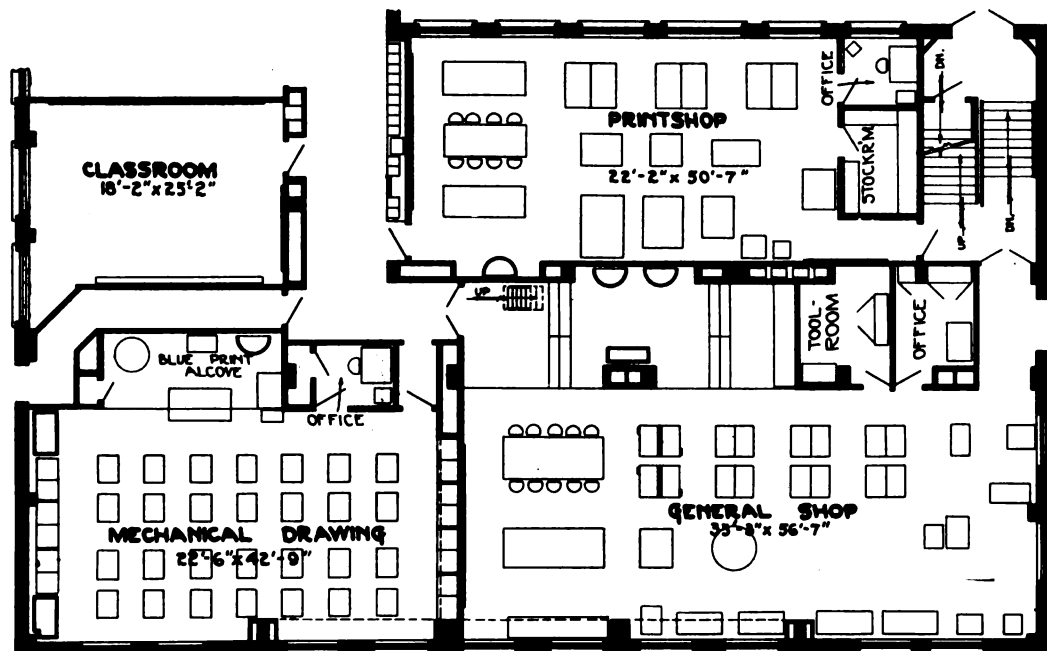


FIG. 14. WESTERN HILLS HIGH SCHOOL, CINCINNATI, OHIO

Any suggestions, therefore, which the writer makes here should be considered as worth only that much; however, each suggestion is the result of experience and has been given careful consideration.

In planning a shop for a typical eight-grade school, we specify a minimum working space of 900 square feet, exclusive of tool, storage, and service rooms; 1,200 square feet is much more to be desired. In addition to 25 42-inch benches, we endeavor to provide one or more wall benches, on which outlets for electrical devices are installed. Since the latter now include electric soldering irons and electric glue pots, the necessity for gas, which was formerly provided, has been eliminated. A toolroom, lumber-storage racks, lockers for storage of unfinished projects, a fireproof cabinet for paints, power-line outlets for lathe or other motor-driven machines, hot and cold water, at least 10 feet of blackboard, and a bulletin board are included.

The size of other shops must, of course, be determined by the amount and type of equipment.

They may range from 1,200 to 4,000 square feet of floor space, and in some cases even more. Generally speaking, there seems to be a tendency on the part of architects and executives to crowd the shop-work into cramped spaces to the detriment of its best development.

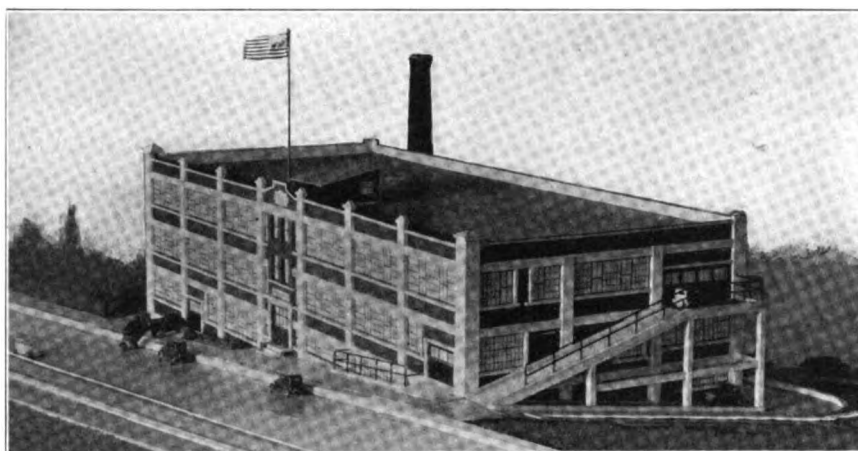
The artificial lighting of school shops depends somewhat on their location and the amount of time daylight is not sufficient. The tendency, however, is to install lights in all new buildings, and we find that from 12 to 15 foot-candles are required in order to approximate the effect of adequate sunlight. Metal fixtures, such as steel reflectors that are white inside and green outside, will often suffice, whereas it might not seem appropriate in classrooms. However, we have found that luminars such as the Ivanhoe Glassteel Diffuser No. 958, with 200 or 300 watt lamps, provide well-diffused light without glare. There has been a decided trend away from single lights over individual machines or benches; the use of sufficient general lighting makes the individual lights unnecessary.

Automotive Trades School, Cincinnati

Ray F. Kuns, Principal

The original plans for the Automotive Trade School was a rough draft of the floor plans prepared by the faculty, which was submitted to the board of education for preliminary approval. After the preliminary approval, the board appointed the architect and issued instructions that he was to be guided by the preliminary plans, insofar as the layout was concerned.

may gather prior to the beginning of class activities. It will further be noted that there is a comparatively small amount of space given to hallways. Space will not permit giving a detailed story of the construction of the building, but the photos and floor plans reproduced herewith, will tell the reader a great deal. A brief description of the floor plans and the uses of the several departments follows.



AIRPLANE VIEW OF AUTOMOTIVE TRADES SCHOOL BUILDING

Further suggestions made by the faculty of the school included the type of construction. This is of the monolithic or reinforced-concrete type. Columns support the floor slabs and the curtained walls; windows and partitions were run in after the floors and roof were completed. The building is somewhat different from the ordinary school building, nor yet is it a garage building—the more desirable features of each type having been incorporated in the school.

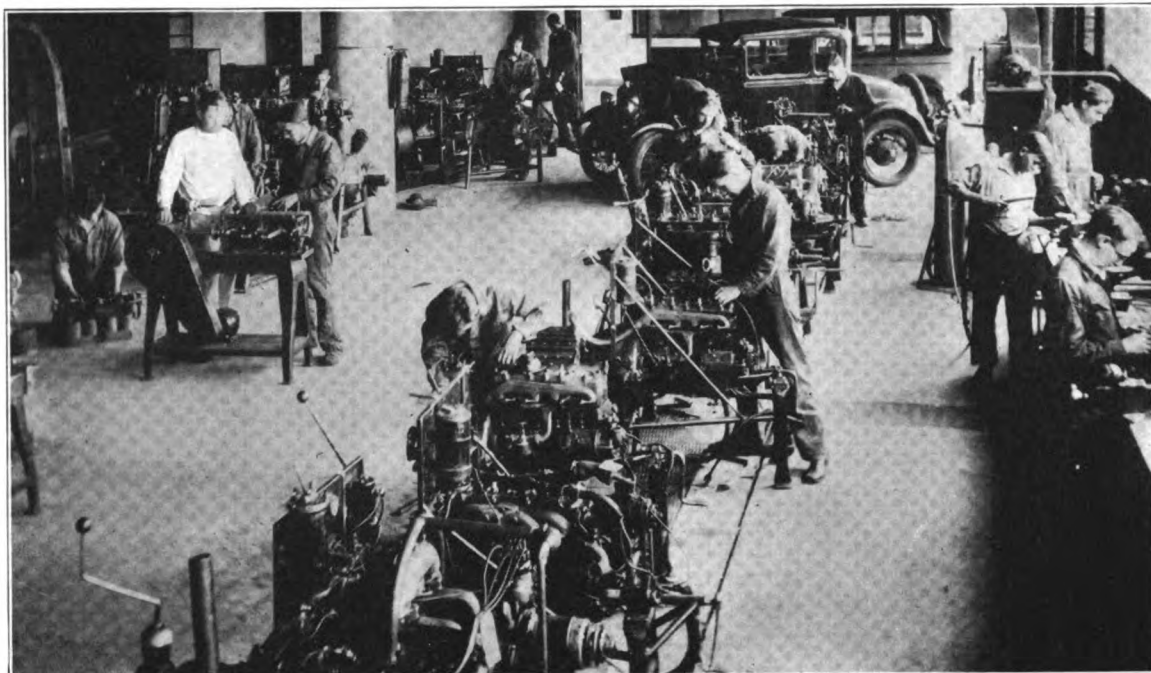
From an administrative viewpoint it seemed desirable to have the shops separated from the class or assembly rooms, so that students need not be in the shops except at those times when they were definitely assigned to work therein. It will be noted that the basement and first floor provide assembly rooms or lecture rooms, where the students

The floor plan of the basement shows a boiler room below the large service room. This is the only sub-basement. The boilers are of the cast-iron low-pressure steam type. The service floor is approximately 67 by 70 feet, with a drive-in from the street and a grade of one foot drop in ten. The lot for the building was selected because it provided an opportunity to put in a drive-in from the street level to two floors, with a ramp to reach the top floor only.

The drive-in to the service floor is near the middle section of the room and another doorway is provided giving access from the school lot. The equipment in the service room includes the usual hand tools, a grinder, a lathe, a drill press, a rotary hoist, a car-washing outfit, and some smaller equipment. Most of the space is left free for car service. The floors are



VIEW FROM REAR OF AUTOMOTIVE TRADES SCHOOL BUILDING

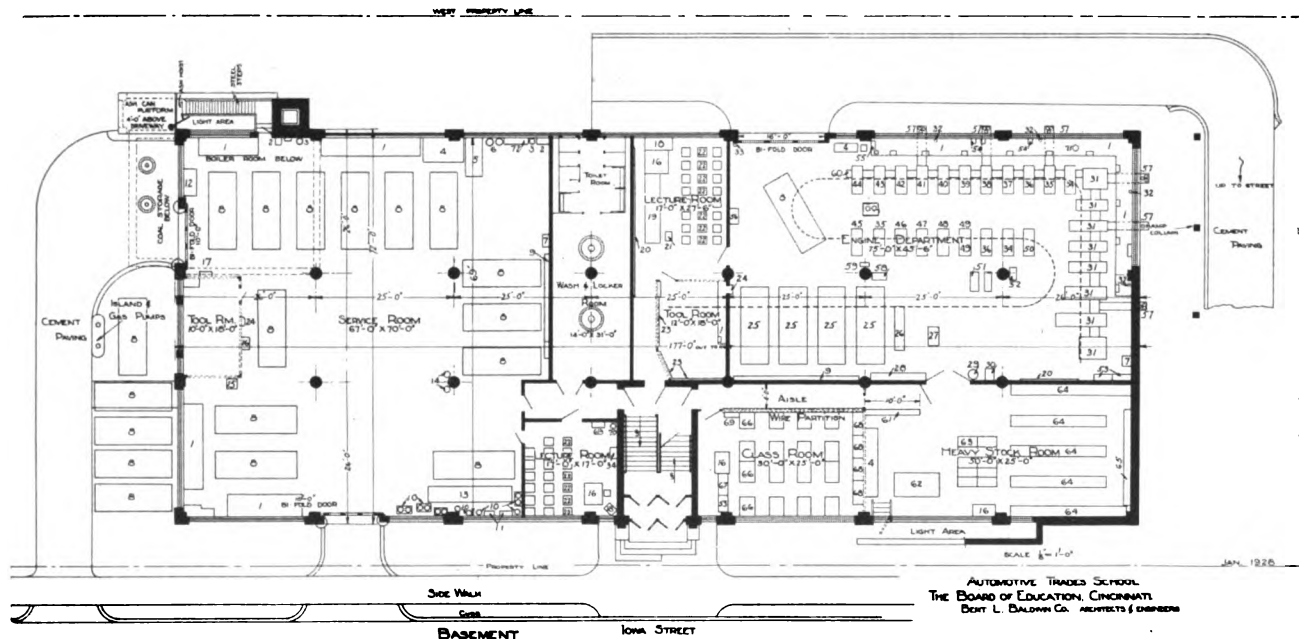


VIEW OF THE ENGINE DEPARTMENT OF THE AUTOMOTIVE TRADES SCHOOL

smooth concrete throughout the entire building. The floors were treated with hardening material, to prevent dust being raised from particles being worn away.

Engine Department

This room is fitted with some power equipment, and in addition has a considerable number of both live and dead motors. Two classes use this room;

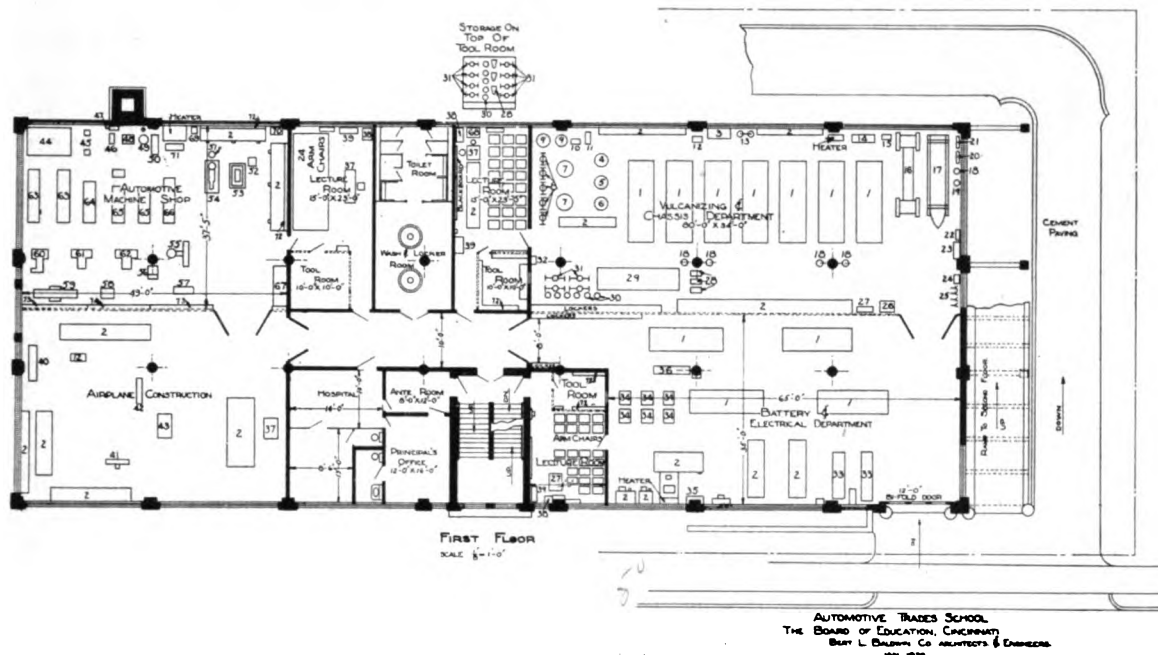


1. Workbench
2. Motor Bench
3. Oil
4. Heater
5. Cleaning Tank
6. Grease
7. Sink
8. Automobiles
9. Lockers
10. Welding Tanks and Racks
11. Cupboards
12. Press
13. Welding Bench
14. Ash Cans
15. Riveter
16. Desk
17. Grinder
18. Filing Cabinet
19. Demonstration Table

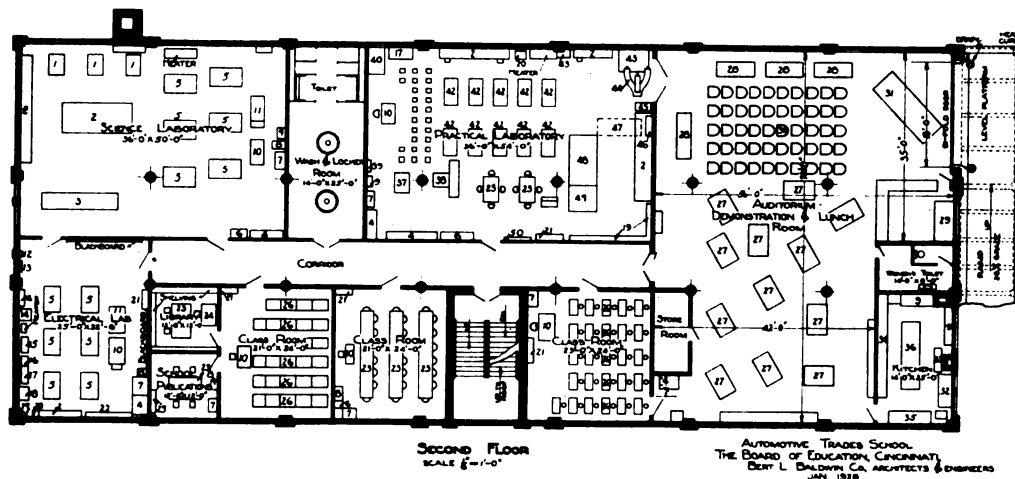
20. Blackboard
21. Special Engine
22. Chairs
23. Tool Panels
24. Pass Window
25. Car Stall
26. Lathe
27. Power Hack Saw
28. Battery Charger
29. Sensitive Drill
30. Radial Drill
31. Aeronautic Engines
32. Air
33. Airline
34. Ford
35. Dodge
36. Chevrolet
37. Reo
38. Cadillac

39. Packard
40. Nash
41. Buick
42. Willys-knight
43. Hudson
44. Franklin
45. Stearns
46. Hupmobile
47. Oldsmobile
48. Chrysler
49. Pontiac
50. Essex
51. Combination Machine
52. Column Grinder
53. Teacher's Lockers
54. Bench Furnace
55. Value Refacer
56. Hydraulic Press
57. Outside Exhaust

58. Stock Keeping Desk
59. Portable Grinder
60. Exhaust and Water System under Floor
61. Service Counter
62. Table
63. Oil Storage
64. Bins
65. Power Switch Panel
66. Desks with Typewriters
67. Billing Machine
68. Tables with Adding Machines
69. Bookcase
70. Flag
71. Bench Drill
72. Trough



- | | | | |
|----------------------------------------------|-----------------------------------------|--------------------------------|-------------------------------------------------------|
| 1. Complete Automobiles—
(Dead and Alive) | 20. Grease Bucket | 39. Bookcase | 59. Planer |
| 2. Workbench | 21. High Pressure Lubricating
Outfit | 40. Wood Lathe | 60. Shaper |
| 3. Tire Rack | 22. Waste Oil Drum | 41. Jointer | 61. Miller |
| 4. Rim Spreader | 23. Lubricants | 42. Band Saw | 62. Universal Miller |
| 5. Tire Spreader | 24. Washstand | 43. Planer 24" | 63. 18"x 10" Lathes |
| 6. Butter | 25. Iron Blocks | 44. Cylinder Grinder | 64. 36"x 8" Brake Drum Lathe |
| 7. Tube Testing Tanks | 26. Parts Cleaning Tank | 45. Anvils | 65. 16"x 6" Lathes |
| 8. Vulcanizing Equipment | 27. Hydraulic Press | 46. Gas Forge | 66. 16x 7" Lathe |
| 9. Boilers | 28. Transmissions | 47. Pyrometer 0-2500 F. | 67. Connecting Rod Bench, Reboring
and Rebabbiting |
| 10. Tube Plate | 29. Cutaway Chassis | 48. Oven Furnace | 68. Personal Cabinet |
| 11. Cavity Mold | 30. Steering Gears | 49. Steam Mains | 69. Soldering Iron Furnace |
| 12. Emery Wheel | 31. Rear Axles | 50. Upright Drill Press | 70. Sink |
| 13. Welding Outfit | 32. Shop Desk | 51. Drill Rack | 71. Foreman's Desk |
| 14. Brake Drum Lathe | 33. Charging Rack | 52. Heavy Grinder | 72. Tool Racks |
| 15. Brake Lining Outfit | 34. Engines | 53. Tee Slots in Floor 8'x 8' | 73. Special Tools |
| 16. Brake Tester | 35. Finishing Rack | 54. Radial Drill 3", Heavy | 74. Steel Storage |
| 17. Grease Rack | 36. Lathe | 55. Universal Cylinder Grinder | |
| 18. Waste Can | 37. Desk | 56. Power Saw | |
| 19. Clean Rag Can | 38. Filing Cabinet | 57. Garage Press | |
| | | 58. Reamer and Cutter Grinder | |



- | | | |
|----------------------------------------|----------------------------|--------------------------------------------------------------|
| 1. Motors | 18. Soldering Table | 36. Bake Table |
| 2. Workbench | 19. Tool Rack | 37. Water Type Dynamometer |
| 3. Cutaway Chassis | 20. Drill Press | 38. Fan |
| 4. Storage Cases or Supply
Cabinets | 21. Bookcase | 39. First-Aid Cabinet |
| 5. Laboratory Tables | 22. Lockers | 40. Battery Charger |
| 6. Notebook Case | 23. Tables | 41. Bench Furnace (Gas) |
| 7. Instructor's Locker | 24. Librarian's Desk | 42. Engines |
| 8. Filing Cabinet | 25. Cabinet | 43. Resistance for Electric Dynamo
(Mounted 8' off Floor) |
| 9. Sinks | 26. Pupils' Desks | 44. Portable Crane |
| 10. Instructor's Desk | 27. Dining Tables | 45. Oxyacetylene Welding Outfit |
| 11. Demonstration Desk | 28. Reading Tables | 46. Control Panel for Electric
Dynamo |
| 12. Switch Box | 29. Heater and Blower Unit | 47. Motor Generator Set on Ceiling |
| 13. Switchboard | 30. Assembly Seats | 48. Electric Dynamo |
| 14. Test Stand | 31. Demonstration | 49. Engine Base |
| 15. Motor Generator | 32. Bake Oven | 50. Bulletin Board |
| 16. Tungar Charger | 33. Range | |
| 17. Lathe | 34. Steam Table | |
| | 35. Electric Refrigerator | |



THE SERVICE FLOOR OF THE AUTOMOTIVE TRADES SCHOOL

one a class in aviation engines, and the other a class in automobile engines. The equipment is indicated in the plan. An item rather difficult to illustrate in the plan is the overhead monorail with which each shop is equipped. On this overhead rail is a 1-ton hoist on a movable carriage. The service room has a hand-operated crane in addition to the hand monorail.

The lecture room in connection with the engine department seats 24 students at tablet-arm chairs, and a demonstration bench is used by the instructor. Above the toolroom, storage space is provided for such items as are used only occasionally. The overhead crane serves to lift and place these items.

Stockroom

Since it is almost impossible to use natural lighting for a stockroom where the bins run almost to the ceiling, the place chosen for it was the corner of the basement where the least natural light was available on account of the street grade. All of the supplies used in the school are handled through the stockroom. It will be noted that the aisle gives access to the stockroom counter. Oils, grease, steel, bolts, nuts, gaskets, brake lining, in fact, all standard types of supplies may be purchased over the counter, the customer paying cash and receiving a cash slip.

Accounting Department

The classroom at the right of the stairs is used as an accounting department, where the students learn those fundamental processes ordinarily made use of in connection with garage work. This room has purposely been located in connection with the stockroom, so that the student might have the benefit of the business transaction therein.

First Floor

The office and the small first-aid or hospital room is located on the first floor. This floor is one-half story above the street level at the center of the building, and level with the street at the corner where the drive-in is shown. It will be noted that a short hall is used, having double doors at each end. It is possible to take an automobile into any room on the first floor, although most of the automobiles are serviced close to the drive-in door.

The battery and electrical departments in conjunction with the vulcanizing and chassis departments, form a double unit in which the usual types of superservice station work are performed.

Vulcanizing and Chassis Department

There is no particular reason why the tire work should be done in the same shop as the chassis work. This is done merely as a matter of expediency. The tire and vulcanizing equipment is modern, and only those processes used in the tire shops of today are taught. A four-wheel Cowdery brake tester, and a Holmes electric car lifter, are two of the major pieces of equipment used in this department for servicing cars.

Battery and Electrical Department

The latest type of battery-charging and handling equipment is in use. The electrical-test equipment is modern. Some engines are maintained in this room for supplementary electrical work. Cars are serviced daily as they come in from the street for battery or electrical work.

Automotive Machine Shop

While every student is required to gain a knowledge of the fundamental machine-shop practice, exercises are not taught, but the students are assigned productive work on the different machines. Practically all of the work done in this room is of automotive content. Perhaps the most valuable feature of the work is the skill which is gained in doing the precision work, so vital in assembling and disassembling automotive units.

Airplane Construction

The space used for this work was originally planned to be used for automobile-body repair, fender and sheet-metal repairs, and welding. Pressure from the outside caused the abandonment of this plan, and the addition of a limited amount of wood-working equipment in this department. Work being done at present is on airplane wings and gliders.

Second Floor

Most of the related trade-information work is centered on the second or top floor of the building. This floor also has the auditorium, demonstration, lunchroom, and the classrooms in which are taught English, civics, and social science. A small library room contains a goodly number of volumes embracing both technical subjects and fiction. Another small room sets off space for those students who are primarily interested in school publications.

Electrical Laboratory

Automotive electrical work is taught in this room. Fundamental principles are developed and practical processes demonstrated. The work between the electrical laboratory and the electrical and battery shop is correlated.

Science Laboratory

In the science laboratory, the related trade in-

formation of a scientific nature, and the shop mathematics also are taught. Close correlation is effected between the work done in the shop and the subject matter which is taught in the science laboratory. Inasmuch as there is such a wealth of material of a scientific nature connected with the automobile, lines may be drawn rather closely. This room is used for first-year work.

Practical Laboratory

The practical laboratory includes ordinary laboratory equipment, and in addition to this, high-grade testing equipment. This work is taken by the second-year cooperative students and those who spend half time at trade work.

The Cafeteria

The lunchroom is a space equipped with furniture

of such nature that it can be made to serve a number of uses. The kitchen is so located that the students may be served quickly, since all the students who attend the school are required to eat in the cafeteria. The tables are portable, and on occasion are set aside so as to make room for chairs to seat an audience of approximately 400 people. The cafeteria space also is used for demonstrating new or unusual cars. These are driven on to the floor directly from the street. It is also possible to take cars into the practical laboratory by taking them up the ramp and through the demonstration room. The cafeteria also is used as a reading room, and all of the current automobile magazines may be found on the reading tables.

Shop Layouts, Equipment and Supply Lists

Planning The School Shop

P. L. Cressman, Director, Industrial and Continuation-School Education,
Harrisburg, Pennsylvania

There are some cities that have set up standards for certain types of shops within their own school systems. These standards are by no means generally accepted, however.

The following table, therefore, is to be looked upon as a tentative set-up rather than a plan which must be definitely adhered to in the laying out of school shops.

It is the result of a study made by a group of city directors of vocational education under the direction of P. L. Cressman, director, industrial and continuation-school education, as part of a course on ad-

shop, provided arrangement can be made elsewhere for storage of materials, projects, etc.

The rooms to be used for school shops should, of course, be dry and well lighted. Provision should be made for sufficient electrical wall outlets for probable later use. Room should be provided for storage lockers and cabinets. These may be made of wood or steel, the latter being preferable in every way.

The doors or windows of the shop should be of such size that they will admit the largest machine that is to be installed. The machinery itself should

SUGGESTIONS FOR SHOP LAYOUTS																								
Type of Shop		Min. Size Square Feet	Desirable Size Square Feet	Type Floor	Ceiling Heights in Feet	Type of Windows	Outside Door Sizes		Lights--12 ft. Candles on Working Plane	Finished Walls	Toolroom	Storage Room Sizes in Feet	Compressed Air Provided	Gas Provided	Washbowls	Switchboard Safety Switch	Blackboards	Exhaust System	Electric Clock Signals	Power Outlets (Minimum capacity in amperes)	Grouped Service Controls	Floor Drains	Drinking Fountains	Remarks
							Feet																	
							Width	Height																
Woodwork	Ind.Arts	1000	2000	1 1/4"	16	Factory	8	10	12	no	no	12x24	yes	yes	yes	yes	yes	no	yes	30	yes	no	yes	Finishing Room, 24 by 28 ft.
	Trade	1250	3000	maple						yes	yes							yes	60					
Electrical Shop	Ind.Arts	1000	1500	1 1/4"	16	Factory	8	10	12	no	no	6x8	yes	yes	yes	yes	yes	no	yes	30	yes	no	yes	Booths, project boards, & storage Balcon-frame building
	Trade	1250	3000	maple						yes	yes							yes	60					
Machine Shop	Ind.Arts	1000	2000	1 1/4"	16	Factory	8	10	12	no	no	6x24	yes	yes	yes	yes	yes	no	yes	30	yes	no	yes	
	Trade	1500	3000	Wood block						yes	yes							yes	60					
Sheet-Metal Shop	Ind.Arts	1000	2000	1 1/4"	16	Factory	8	10	12	no	no	8x12	no	yes	yes	yes	yes	no	yes	30	yes	no	yes	
	Trade	1250	3000	maple						yes	yes							yes	60					
Printing	Ind.Arts	1000	1500	1 1/4"	16	Factory	8	10	12	no	no	8x12	yes	no	yes	yes	yes	no	yes	30	yes	no	yes	
	Trade	1500	3000	maple									yes					yes	60					
Mechanical Drawing	Ind.Arts	1000	1250	1 1/4"	16	Factory	Regular Classroom Size		12	yes	no	8x12	no	yes	yes	yes	yes	no	yes	30	yes	no	yes	Blue-print room, 12 by 24 ft. with gas dryer and running water
	Trade	1250	2000	maple														yes	60					
Auto Shop	Ind.Arts	1250	2000	Concrete treated	16	Factory	12	12	12	no	yes	8x12	yes	yes	yes	yes	yes	yes	yes	30	yes	yes	yes	Water hose connection
	Trade	2000	3000																30					
General Shop		1250	2500	1 1/4" maple	16	Factory	8	10	12	no	yes	12x24	yes	yes	yes	yes	yes	yes	yes	60	yes	no	yes	

ministration of vocational education at the summer session at Pennsylvania State College.

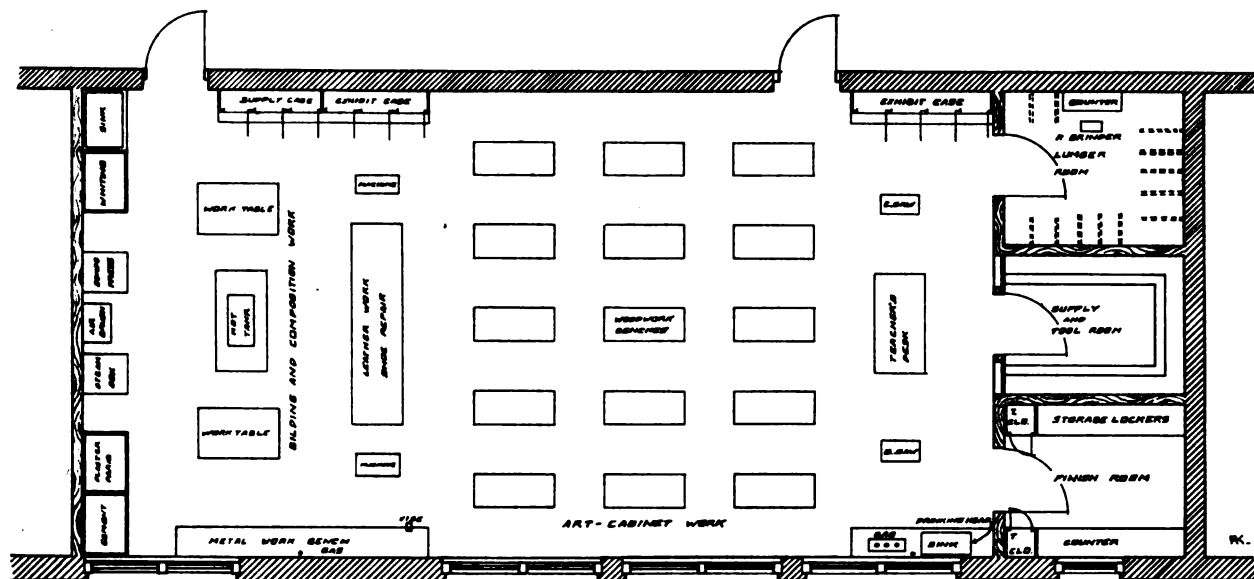
Some of the items were questioned by various members of the class. For instance, the 16-ft. ceiling height might in many instances be reduced to 12 ft. Then, too, the minimum size suggested for a shop is 1,000 sq. ft. This is approximately a unit and one-half classroom (the unit classroom being 24 by 28 ft.). In cases of necessity, even a unit classroom may be turned into a fairly respectable

be so located that when in use, neither the product nor the operator will be interfered by anyone working on an adjacent machine or bench.

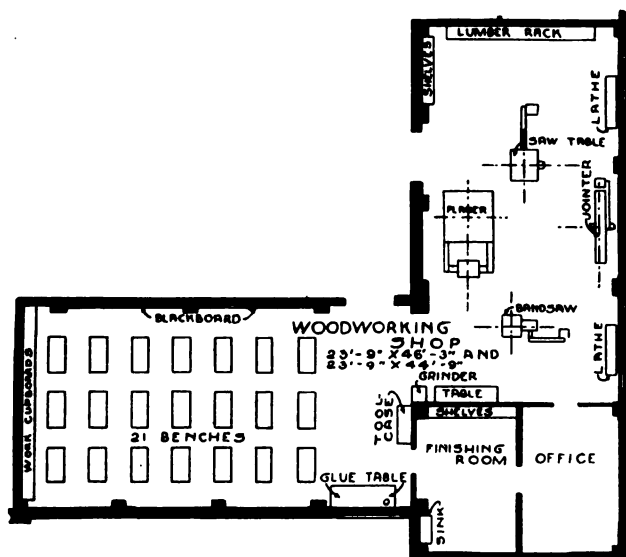
The layouts which follow represent shops in actual use in various schools throughout the country. A study of these will materially assist in arriving at a suitable arrangement for a shop to be placed in an existing room, or in planning for one that is to go into a new school building.

Woodworking-Shop Layouts

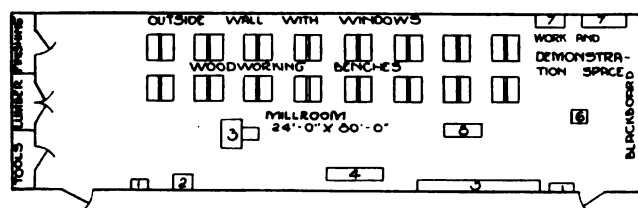
For outline of woodworking course, see page 256
For equipment and supply list, see page 78



COMPOSITE MANUAL-TRAINING ROOM, ELEMENTARY SCHOOLS, LOS ANGELES, CALIF.

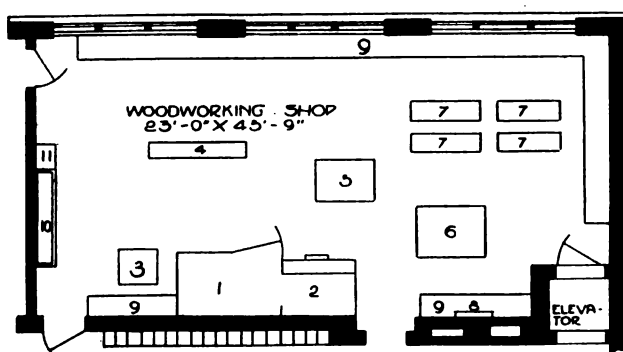


WOODWORKING SHOP, GEORGE WYTHE JUNIOR HIGH SCHOOL, RICHMOND, VA.



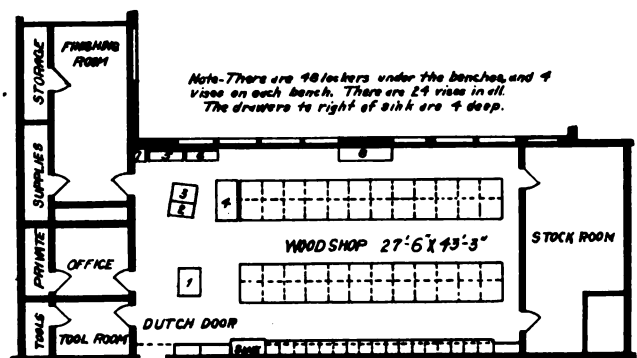
ALEXANDER HAMILTON JUNIOR HIGH SCHOOL, CLEVELAND, OHIO

- | | |
|------------|------------------------|
| 1. Sink | 5. Cupboards |
| 2. Grinder | 6. Desk |
| 3. Saw | 7. Lathe |
| 4. Jointer | 8. Demonstration Bench |



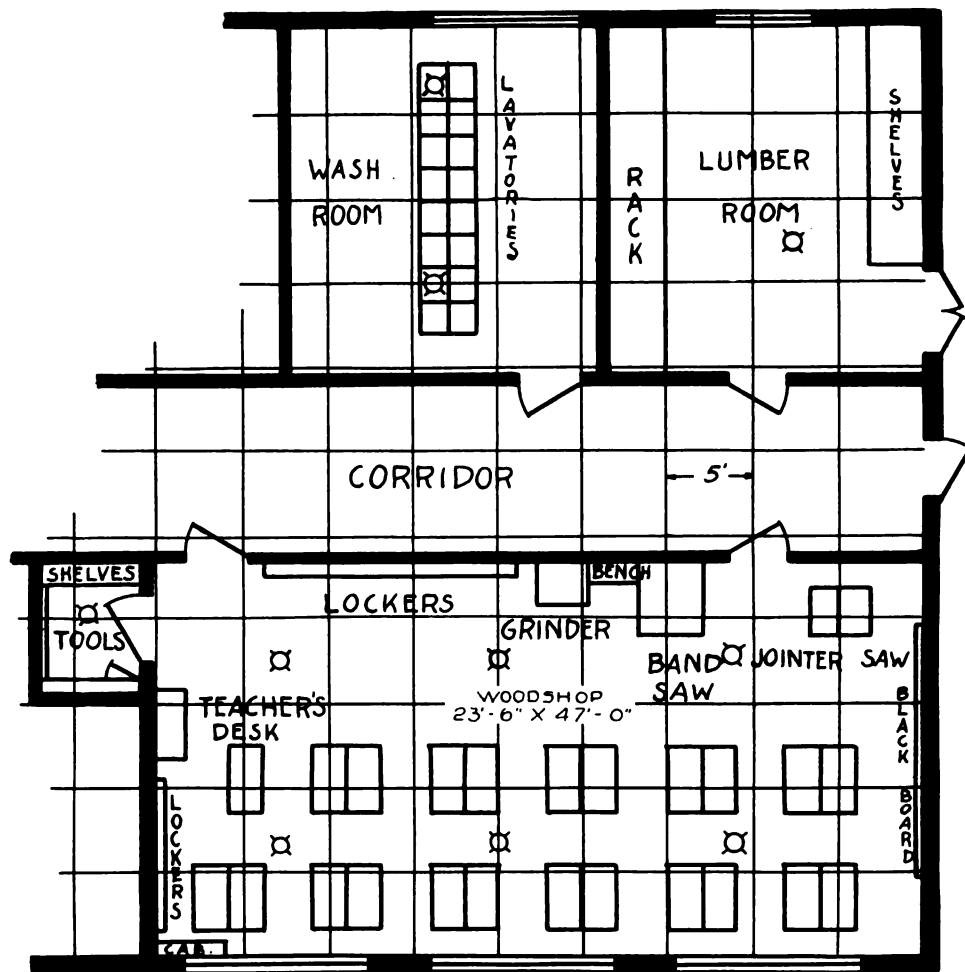
WOODWORKING SHOP, NORMANDIN JUNIOR HIGH SCHOOL, NEW BEDFORD, MASS.

- | | |
|---------------------|--------------------------|
| 1. Teacher's Office | 7. 12-in. Turning Lathes |
| 2. Toolroom | 8. Switchboard |
| 3. Band Saw | 9. Benches |
| 4. Jointer | 10. Wash Sink |
| 5. Circular Saw | 11. Electrical Grinder |
| 6. Surface Planer | |

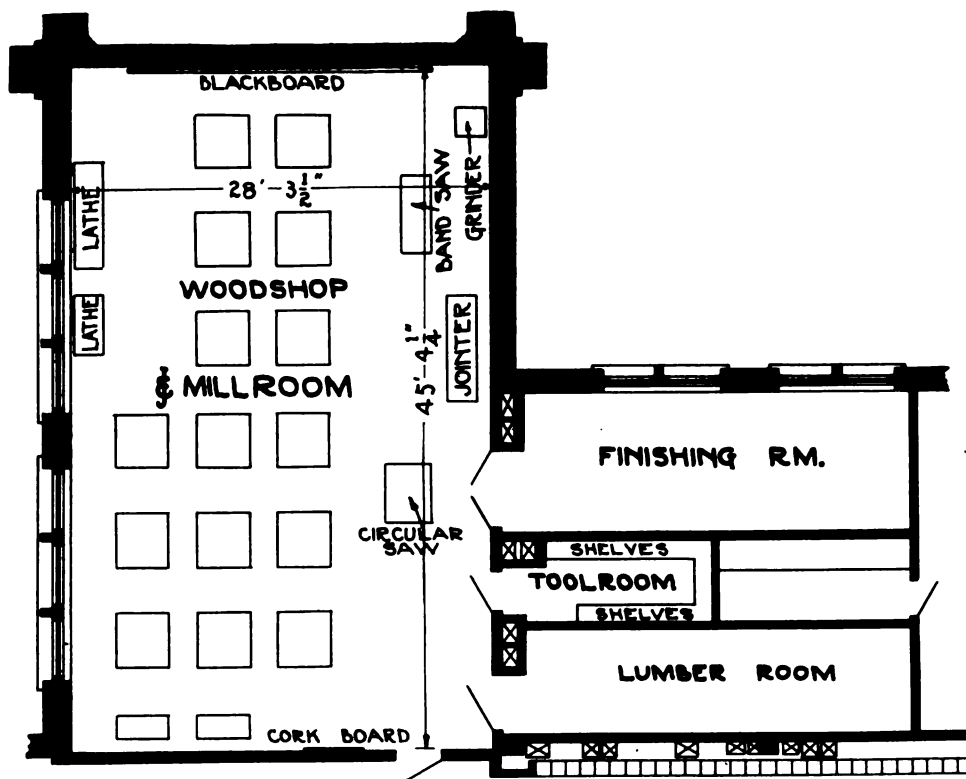


WOOD SHOP, NORTH JUNIOR HIGH, EVERETT WASH.

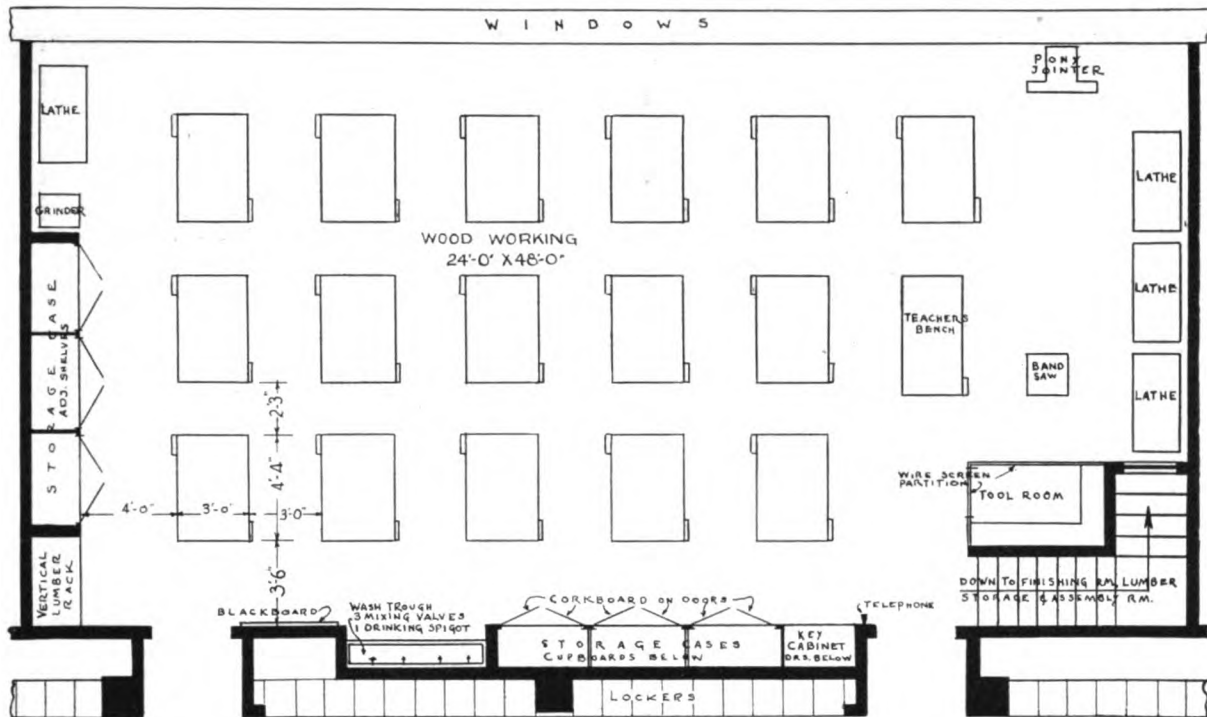
- | | | | |
|-------------|------------------|----------|------------------|
| 1. Band saw | 3. Universal saw | 5. Lathe | 7. Motor |
| 2. Jointer | 4. Emery wheel | 6. Lathe | 8. General tools |



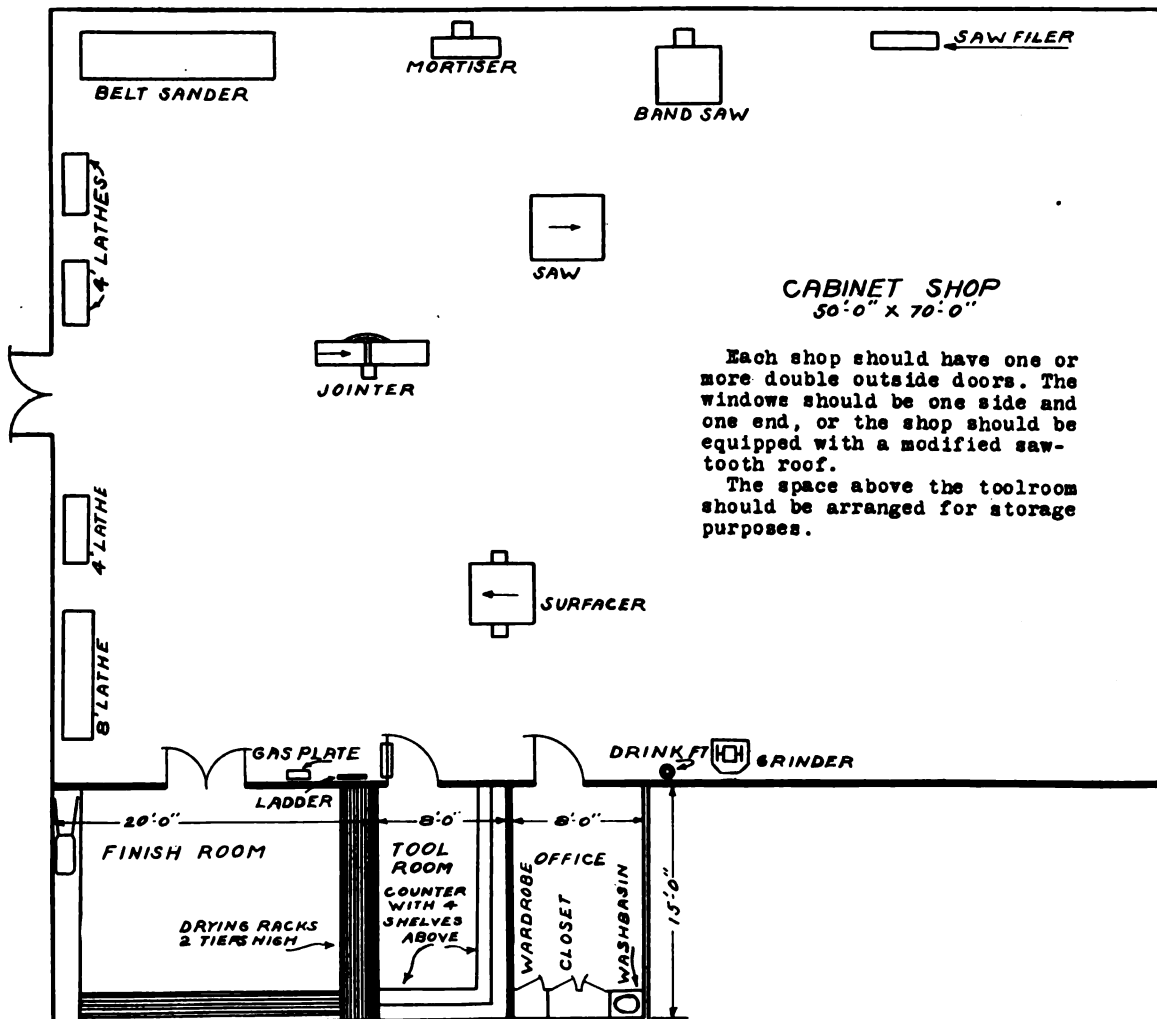
WOODSHOP, ROOSEVELT JUNIOR HIGH SCHOOL, TULSA, OKLA.



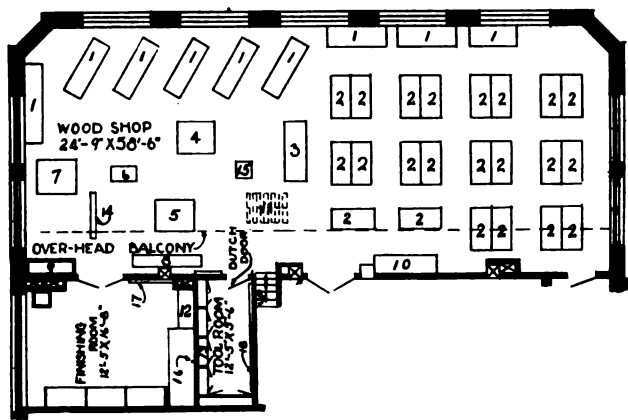
JUNIOR HIGH SCHOOL, CLEVELAND, OHIO



JUNIOR-HIGH-SCHOOL WOODWORKING SHOP, CHICAGO, ILLINOIS

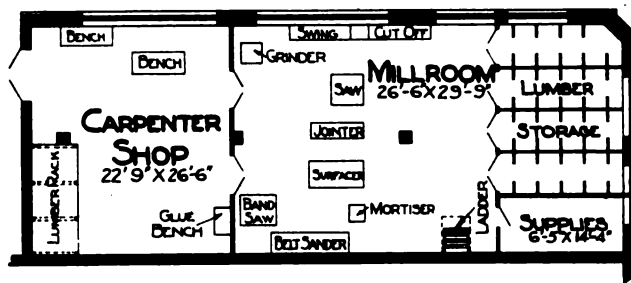


STANDARD CABINET SHOP, HIGH SCHOOL, OAKLAND, CALIF.

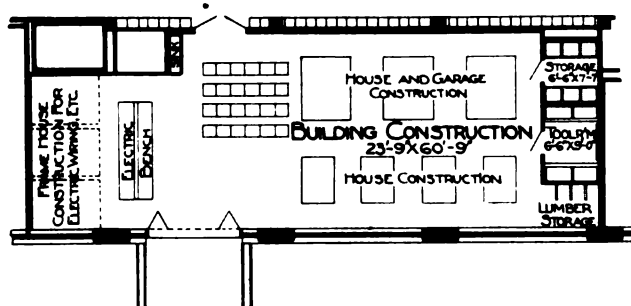


WOODSHOP, PONTIAC HIGH SCHOOL, PONTIAC, MICH.

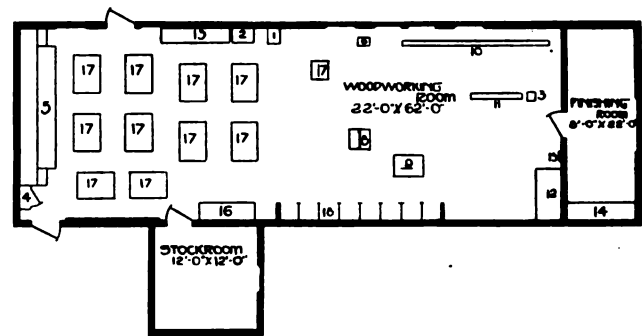
- | | |
|-------------------------------------|----------------------------------------------------------------|
| 1. Lathes | 11. Hinged Safety Trapdoor with Steel Stair to Basement |
| 2. Benches | 12. Steel Cabinet |
| 3. Instructor's Demonstration Table | 13. Shelves—Cases below |
| 4. Surfer | 14. Hoist to Balcony |
| 5. Saw Bench | 15. Grinder |
| 6. Mortiser | 16. Compressed Air Outlet Connected to Compressor in Auto Shop |
| 7. Band Saw | 17. Clamp Rack |
| 8. Jointer | 18. Tool Board |
| 9. Sink | |
| 10. Unit Case | |



PONTIAC HIGH SCHOOL, PONTIAC, MICH.

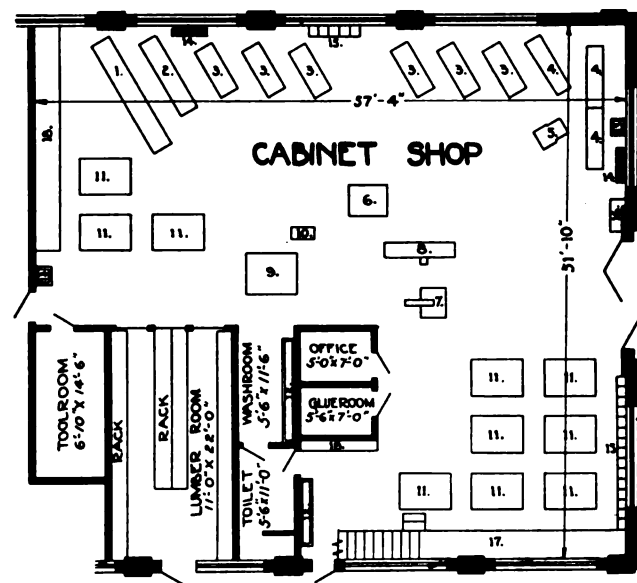


PONTIAC HIGH SCHOOL, PONTIAC, MICH.



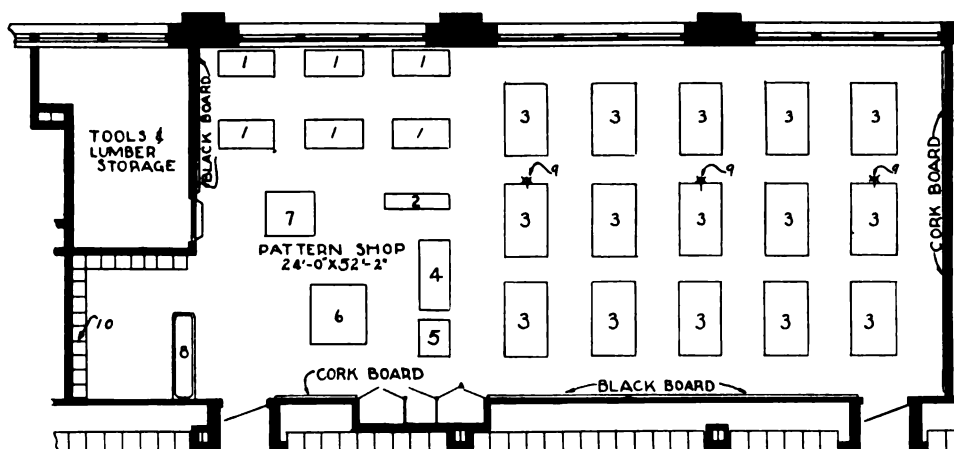
WOODSHOP, UNION HIGH SCHOOL, KLAMATH FALLS, OREGON

- | | |
|------------------------|------------------------------|
| 1. Grinder | 10. Three Woodturning Lathes |
| 2. Sink | 11. Engine Lathe |
| 3. 7 1/2 H.P. Motor | 12. Machinist Bench |
| 4. Instructor's Locker | 13. Glue Bench |
| 5. Elevated Seats | 14. Finishing Bench |
| 6. Mortiser | 15. Post Drill |
| 7. Band Saw | 16. Tool Cabinet |
| 8. Surfer | 17. Double Benches |
| 9. Table Saw | 18. Lockers |



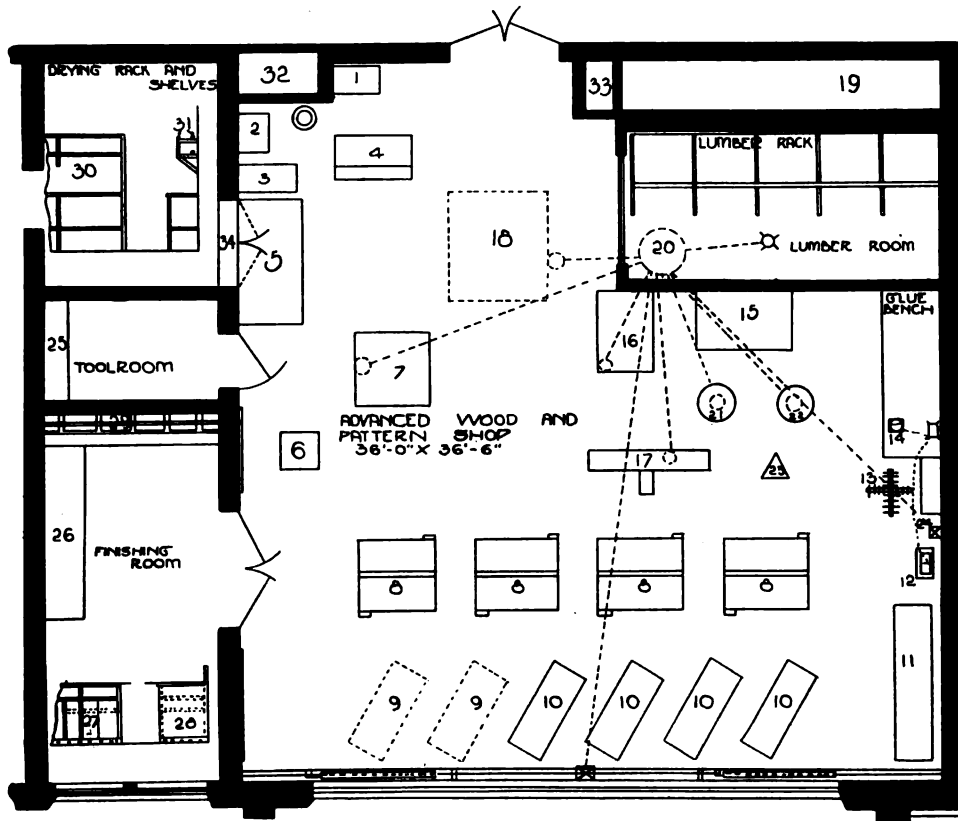
JOHN C. FREMONT HIGH SCHOOL, LOS ANGELES, CALIF.

- | | |
|--------------------|---------------------|
| 1. 24" x 10' Lathe | 10. Mortiser |
| 2. 12" x 6' Lathe | 11. Double Benches |
| 3. 12" x 4' Lathe | 12. Wash Trough |
| 4. 12" x 5' Lathe | 13. Sinks |
| 5. Grinder | 14. Radiators |
| 6. Circular Saw | 15. Steel Lockers |
| 7. Band Saw | 16. Glue Pot Table |
| 8. Jointer | 17. Large Workbench |
| 9. Planer | 18. Wood Lockers |



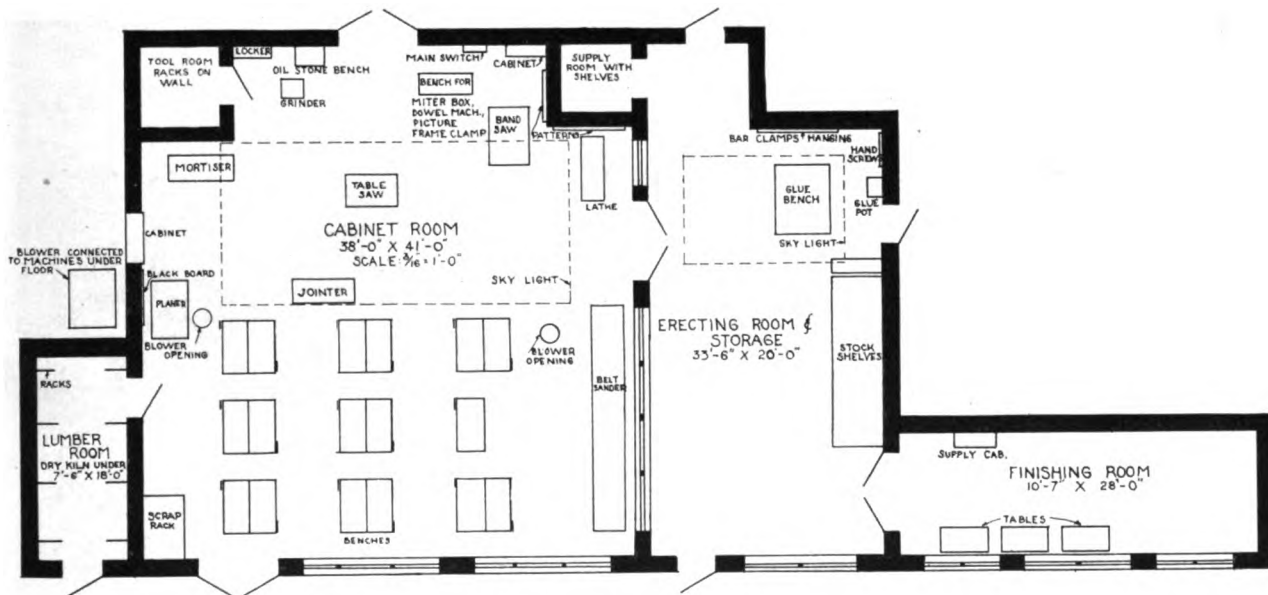
PATTERN SHOP, LANE TECHNICAL HIGH SCHOOL, CHICAGO, ILL.

- | |
|--------------------------|
| 1. Lathes |
| 2. Jointer |
| 3. Benches |
| 4. Instructor's Table |
| 5. Portable Sander |
| 6. Band Saw |
| 7. Circular Saw |
| 8. Sink |
| 9. Outlets for Glue Pots |
| 10. Lockers |



1. Filing Case
2. Wash Bowl
3. Parting Sand Box
4. Desk
5. Molding Box 40"x 78"
6. Oilstone Grinder
7. Variety Saw 38"x 41"
8. Benches 22"x 53"
9. Future Lathe
10. 12"x 5' Speed Lathe
11. 12"x 8' Lathe
12. Portable Hand Jointer
13. Rack for Hand Clamps
14. Glue Pot
15. Mortiser 36"x 44"
16. Band Saw 25"x 50"
17. 12" Jointer
18. Future Surfer 3'-2"x 5'-8"
19. Fresh-Air Intake
20. Fan and Blower System
21. Spindle Sander
22. Sander
23. Trimmer
24. Blower Outlet
25. Shelves and Drawers
26. Stain Bench Drawers and Cupboard Below
27. Drawers and Shelves
28. Splash Board
29. Drying Shelves and Racks
30. Shelves
31. Slats 8" Apart
32. Hot Air
33. Cold Air
34. Power Panel Automatic Switches

HAMTRAMCK VOCATIONAL SCHOOL, HAMTRAMCK, MICH.



CABINET SHOP, LA CROSSE VOCATIONAL SCHOOL, LA CROSSE, WIS.

Woodworking Equipment

Major Equipment

20 to 25 Students Per Class

Name and Description	Elementary School	Junior High School	Senior High School	Technical High and Full-Time Vocational Schools	Part-Time Vocational School
Benches					
Hardwood tops, 1¾ in. or over in thickness, built up of strips with tongue-and-groove joints, the top to project far enough to allow a rapid-acting or continuous screw vise to be attached. It is a good idea to order a 1-in. birch or maple board wide enough to cover the working face of the bench at the time of buying the benches. This board can then be fastened to the top proper with screws and may be conveniently replaced when worn. The benches should be made of thoroughly kiln-dried lumber throughout. They may be either plain or of 6-drawer type	25	25	25	25	25
Glue	1	1	1	1	1
Stain, with metal-covered top	1	1	1	1	1
Teacher's Demonstration....	1	1	1	1	1
Blackboard					
Permanent or portable			1 or more		
Bookcase					
For reference books, catalogs, etc.			1 or more as required		
Bulletin Board			1 or more		
Cabinets , wood or metal for filing class records, instruction sheets, drawings, etc....			1 or more as required		
Chairs					
Tablet-arm chairs	25	25	25	25	25
Core Oven (for patternmaking class only)	0	0	1	1	1
Desk					
Teacher's, with drawer compartments	1	1	1	1	1
Chair, to match desk.....	1	1	1	1	1
Furnace , for melting soft metals (for patternmaking class only)	0	0	1	1	1
Glue Pot , 1-qt., or 2-qt. size, electric, gas, or steam heat..	2	2	2	2	2
Glue Warmer or Cooker 1 to 5 gal. capacity.....	0	0	1	1	1
Grinder					
Automatic knife, direct motor-drive type. Size to suit largest knife used in the school shop. Grinder to be complete with water pump, grinding wheel, and automatic stops	0	0	0	1	0
Bench, hand or power.....	1	1	0	0	0

See classified directory for sources of supply

Name and Description	Elementary School	Junior High School	Senior High School	Technical High and Full-Time Vocational Schools	Part-Time Vocational School
Bench, motor-in-head. Motor bearings to be completely housed. Wheels to be equipped with safety flanges and carefully guarded throughout. One fine-grit, and one coarse-grit wheel	0	0	1	1	1
Revolving oilstone, pedestal type, with one fine and one coarse oilstone	0	0	1	1	1
Jointer					
6- or 8-in. portable jointer. Table to be fitted for rabbeting. Safety-cylinder type, and equipped with safety guard	0	1	1	1	1
12-, 16-, or 18-in. direct motor-drive, ball-bearing. Cylinder to be of safety-head type. Table to be fitted for rabbeting. Jointer to be equipped with safety guard	0	1	1	1	1
Lantern					
Stereopticon-view machine for opaque objects and standard-type lantern slides	0	0	1	1	1
Lathes					
6- to 16-in. motor-in-head, motor-in-base, or belt-driven speed lathe, to take 24, 36, 48, 60, or 72 in. between centers. Each to be complete with cup center, spur center, faceplate, rosette chuck, tool rests, and center drift for head block...	0	4	4	6	6
Patternmakers, with end faceplate provision. Lathe to be of direct motor-drive type, equipped with variable-speed motor, faceplates and floor stand. (For patternmaking class only).	0	0	1	1	1
Mortiser					
Direct motor, or belt driven, hollow-chisel mortiser, foot feed. Table to be of the tilting type with hold-down clamps and stop rod.....	0	1	1	1	1
Portable, vertical, hollow-chisel mortiser, bench type	0	1	1	1	1
Planer					
12-, 18-, 20-, 24-, or 30-in. motor or belt-driven, single-surface planer. Safety-head cylinder, three-knife type, fitted with good-grade steel knives. Knife setting and jointing device complete with bar should be mounted on machine if possible	0	0	1	1	1
Saws					
Band Saw, 20- to 36-in. motor drive. Upper and lower wheels to be completely guarded. Table to tilt to 45 deg.	0	1	1	1	1
Combination, band saw, cross-cut saw, rip saw, and mortiser. Machine to be completely guarded	0	1	1	1	1

Use post-card service for special information

Name and Description	Elementary School	Junior High School	Senior High School	Technical High and Full-Time Vocational Schools	Part-Time Vocational School
Cut-off, pedestal or swing type to be fitted with 12- to 16-in. saw	0	0	1	1	1
Filing machine, direct motor-drive	0	1	1	1	1
Jig, direct motor-drive	0	0	1	1	1
Portable band saw, 16 to 20-in. ball-bearing, motor driven	0	1	1	1	1
Saw bench, direct connected to motor, and to have both rip and crosscut saws. Rip and crosscut gauges also to be provided	0	1	1	1	1
Universal saw bench, 14 to 16-in., motor driven	0	0	1	1	1
Variety saw bench, motor-driven, tilting table, with universal sliding table. The arbor is to be fitted for a dado head, and the table is to be slotted accordingly. The saw is to be equipped with ripping fence and miter cut-off gauges	0	1	1	1	1
Sander					
Belt, direct motor-drive.....	0	0	1	1	1
Disk, motor or belt driven...	0	0	1	1	1
Oscillating-spindle, motor driven	0	0	1	1	1
Portable, hand-plane type. Direct motor-drive	0	1	1	1	1
Verticle-spindle and disk sander	0	0	1	1	1
Shaper					
Motor-drive, single or double spindle. Table to be equipped with removable center plate	0	0	1	1	1
Portable shaper or router with a suitable selection of cutters	0	1	1	1	1
Tenoner					
Single end, with coping heads and cut-off saw	0	0	1	1	1
Vises, rapid-acting or solid-nut type woodworking bench vises, 7 to 10-in. face.....	26	26	26	26	26
Wood Trimmers, complete with all gauges and taper pins. Base of trimmer to be slotted and laid out for degree settings. (For patternmaking class only).....	0	0	1	2	1

See classified directory for sources of supply

Woodworking Equipment

Small Tools

20 to 25 Students Per Class

Name and Description	Elementary School	Junior High School	Senior High School	Technical High and Full-Time Vocational Schools	Part-Time Vocational School
Awls, Brad, assorted sizes.....	12	12	12	12	12
Bevels					
Protractor	1	1	1	2	1
Sliding T, 8"	2	2	4	6	4
Bits					
Auger, $\frac{1}{8}$ " to 1" inclusive by 16ths, each	1	1	2	3	3
Auger, $\frac{1}{8}$ " to $\frac{1}{2}$ " inclusive by 16ths, each	3	3	3	3	3
Braces, ratchet type, 8", 10", or 12" sweep	6	6	6	0	0
Braces, ratchet type, 10", 12", or 14" sweep	0	0	0	6	6
Countersink, for wood, rose pattern, $\frac{1}{2}$ " and $\frac{5}{8}$ ", 3 each	6	6	6	6	6
Dowel, square shank, $\frac{1}{4}$ ", $\frac{1}{8}$ ", $\frac{3}{8}$ ", $\frac{1}{2}$ ", $\frac{3}{4}$ ", each....	2	2	2	3	2
Expansive, $\frac{7}{8}$ " to $1\frac{1}{2}$ "	0	1	2	2	1
Expansive, $\frac{7}{8}$ " to 3"	1	1	1	2	1
Forstner, square shank, $\frac{1}{4}$ " to $\frac{1}{2}$ " inclusive, by 16ths, each	2	2	2	2	2
Screw Driver, square shank, $\frac{1}{4}$ ", $\frac{1}{8}$ ", $\frac{3}{8}$ ", each	1	2	2	4	4
Twist Drill for wood, square shank, $\frac{1}{8}$ " to $\frac{3}{8}$ " inclusive by 16ths, each	2	2	2	2	2
Twist Drill, straight shank, $\frac{1}{8}$ " to $\frac{3}{8}$ ", inclusive by 32nds, each	6	6	6	12	6
Blow Torch	0	0	1	1	1
Brooms	2	2	2	2	2
Brushes					
Bench Duster, 10"	24	24	24	24	24
Glue, round, $\frac{1}{4}$ " and $\frac{3}{4}$ ", each	1	4	12	12	6
Glue, round, $1\frac{1}{2}$ "	0	4	6	6	4
Marking, camel's hair, No. 1 and No. 2, each	6	12	12	12	6
Varnish, flowing, 2"	2	4	0	0	0
Varnish, flowing, $2\frac{1}{2}$ "	0	0	12	12	3
Varnish, flat, $\frac{1}{2}$ "	24	24	24	24	24
Varnish, flat, $\frac{3}{4}$ "	6	12	18	18	6
Varnish, flat, 1"	0	12	18	18	6
Burnishers, oval or round.....	2	2	6	12	12
Calipers					
6", outside	1	1	1	1	1
6", inside	1	1	1	1	1
12", outside	0	0	1	1	1
12", inside	0	0	1	1	1
Carving Tools					
Sets containing 6 tools.....	1	1	0	0	0
Sets containing 12 tools.....	0	0	1	1	1
Chisels					
Cold, machinists', $\frac{3}{8}$ " and $\frac{1}{2}$ ", 1 each	2	2	2	2	2
Mortising Chisel and Bits, $\frac{1}{4}$ " to $\frac{3}{8}$ " by 16ths, each..	0	2	2	2	2
Socket-firmer, bevel edge, $\frac{1}{8}$ ", 1", and $1\frac{1}{4}$ ", each....	6	6	12	12	6
Socket-firmer, bevel edge, $\frac{1}{4}$ ", $\frac{1}{2}$ ", and $\frac{3}{4}$ ", 12 each..	36	36	36	36	36
Socket-firmer, plain edge, $\frac{1}{2}$ ", $\frac{3}{4}$ ", and 1", 6 each....	18	18	18	18	18
Tanged-firmer, bevel edge, $\frac{1}{8}$ ", $\frac{1}{4}$ ", $\frac{1}{2}$ ", $\frac{3}{4}$ ", 1", and $1\frac{1}{4}$ ", each	0	0	12	12	6

Use post-card service for special information

Name and Description	Elementary School	Junior High School	Senior High School	Technical High and Full-Time Vocational Schools	Part-Time Vocational School
Clamps					
Screw, adjustable, 24", 36", and 48", 12 each.....	36	36	36	36	36
Screw, adjustable, 60".....	0	0	0	12	12
Tilting Saw	0	1	1	1	1
Dividers, Wing, 6" and 10", each	3	3	6	6	6
Doweling Jigs, with bushings..	3	3	3	3	3
Dowel Plate, 6" long.....	1	1	2	2	2
Drawknives, 7".....	0	1	1	2	1
Drill					
Automatic Hand, with 8 drill points	0	0	2	2	1
Chuck, 0 to 3/8".....	0	1	1	2	1
Hand, 0 to 3/8", for round-shank drills	2	2	6	6	3
Star, for concrete, 1/2" and 3/4", each	0	0	2	2	2
Files					
Auger Bit, assorted 6".....	6	6	12	12	6
Cabinet, 8" and 10", each....	6	6	12	12	12
Card and Brush.....	2	2	2	3	3
Flat, wood 10".....	6	6	12	24	12
Mill, bastard cut, 10".....	3	3	6	12	6
Round, bastard cut, 12".....	3	3	6	12	6
Taper, slim, 5 1/2" and 7", each	3	3	12	12	12
First-Aid Cabinet and Supplies	1	1	1	1	1
Floor Brushes	4	4	4	4	4
Gauges					
Bit, adjustable	1	1	1	1	1
Jointer	1	1	1	1	1
Marking, metal or hardwood	24	24	24	24	24
Mortise, metal or hardwood.	1	1	3	6	6
Panel	0	0	1	1	1
Glass Cutter	0	3	3	3	3
Gouges					
Tanged-firmer, outside ground, handled, 1/8", 1/4", 1/2", 3/4", 1", each.....	2	2	2	6	3
Tanged-firmer, inside ground, handled, 1/8", 1/4", 1/2", 3/4", 1", each	0	2	6	6	3
Spoon, 1/2", 3/4", and 1", each	0	0	2	6	3
Hammers					
Claw, bell-faced, 10 oz.....	20	0	0	0	0
Claw, bell-faced, 12 oz.....	0	20	24	0	0
Claw, bell-faced, 13 oz.....	0	5	6	6	12
Claw, bell-faced, 16 oz.....	0	0	0	24	12
Hand Screws					
Adjustable, length of jaws, 4", 5", and 6", each.....	0	0	0	18	6
Adjustable, length of jaws, 7", and 8", each.....	0	6	12	18	6
Adjustable, length of jaws, 10", 12", and 14", each.....	4	4	12	18	6
Hatchet, Bench, 4" cut.....	2	2	2	2	2
Jars, Earthenware, 1-qt. capacity	12	12	12	18	12
Knives					
Jointer, to fit power machine	0	1	1	1	1
Planer, to fit power machine.	0	1	1	1	1
Sloyd, 3" blade.....	12	12	24	24	24
Levels					
Wood, 24"	0	1	2	2	2
Machinists', 12"	0	0	1	1	1
Mallets, Hickory, 3" by 5" head	6	6	12	12	6
Nail Sets, Point, 1/8" and 1/4", each	3	3	3	6	3

See classified directory for sources of supply

Name and Description	Elementary School	Junior High School	Senior High School	Technical High and Full-Time Vocational Schools	Part-Time Vocational School
Oilers, Bench, $\frac{1}{8}$ pt. coppered, best grade	3	3	6	12	6
Oilstones					
1"x2"x8" in iron box.....	3	3	12	12	12
Gouge Slip, medium, $4\frac{1}{2}$ "x $2\frac{1}{8}$ "x $\frac{3}{8}$ "x $\frac{1}{8}$ "	3	3	4	12	6
Gouge Slip, fine, 3"x2"x $\frac{3}{8}$ "x $\frac{1}{8}$ "	2	2	3	6	3
Pincers, 6" carpenters'	3	6	6	6	3
Planes					
Block, adjustable, 6" long, $1\frac{3}{8}$ " cutter	6	6	12	24	12
Combination, adjustable	1	1	3	3	1
Core Box	0	0	1	1	1
Duplex, fillister and rabbet..	1	1	3	3	3
Irons, double	24	24	24	24	24
Jack, 14", 2" cutter.....	12	24	24	24	24
Jointer, 24"	1	1	3	6	3
Round, wood, $1\frac{3}{4}$ "	0	0	2	2	2
Router	2	2	6	6	3
Smooth, 9", $1\frac{3}{4}$ ", or 2" cutter	24	24	24	24	24
Pinch Dogs, $\frac{3}{4}$", 1", and $1\frac{1}{4}$" each	0	0	12	24	12
Pliers					
Round-nose, 5"	1	1	2	3	2
Side-cutting, 6"	1	1	2	2	2
Putty Knives	2	2	3	6	3
Rasps, half-round, wood, 10"...	2	2	6	12	6
Rules					
Board	1	1	1	1	1
1' or 2' graduated by 8ths and 16ths	24	24	24	24	24
Shrink, $\frac{1}{8}$ ", $\frac{1}{4}$ ", each.....	0	0	3	24	6
Saws					
Back, 12", 14 point.....	0	24	24	6	24
Band, $\frac{1}{4}$ ", $\frac{1}{2}$ ", $\frac{3}{4}$ ", to fit power machine, each.....	0	2	2	3	2
Compass, 10"	3	3	6	9	2
Coping, frames	24	12	12	12	12
Coping, blades	144	72	72	72	72
Crosscut, 9-tooth, 22" long..	12	12	12	12	6
Crosscut, circular for power machine	0	1	2	3	2
Dado, $\frac{1}{8}$ " to $1\frac{1}{8}$ " to fit power-saw arbor	0	1	1	1	1
Hack, frames, 8" or adjustable	1	1	2	2	2
Hack, blades, 8"	12	12	24	24	24
Keyhole, 10", 10 point.....	0	3	3	3	3
Rip, 7 point, 22" long.....	6	6	6	6	4
Rip, circular for power machine	0	1	2	3	2
Set, 10 points per inch and finer	1	1	1	2	2
Set, 10 points per inch and coarser	1	1	1	2	2
Turning frame, 14".....	1	1	1	2	1
Turning blades, $\frac{1}{4}$ "x12", 10 tooth	12	12	6	6	6
Miter-box, 24"x4" saw, 7" capacity at miter.....	1	1	1	2	1
Scrapers					
Cabinet	3	6	6	12	12
Glue, triangular	2	2	6	6	6
Veneer, blade $2\frac{3}{4}$ " long, handle 11" long.....	1	4	4	6	4
Screw Drivers					
Cabinetmakers', 4", 6", and 8" each	6	6	6	9	6
Quick-return, spiral ratchet.	2	4	6	6	3
Shoot Board, and plane.....	1	1	1	2	1
Snips, Tinnners', forged steel, $2\frac{1}{2}$" cut	1	1	1	1	1

Use post-card service for special information

Name and Description	Elementary School	Junior High School	Senior High School	Technical High and Full-Time Vocational Schools	Part-Time Vocational School
Spokeshaves , adjustable, raised handle, 10" long	6	6	6	6	6
Squares					
Combination, 12"	0	3	3	6	3
Try-, iron handle, 8"	24	24	24	24	24
Framing, 2'	1	1	2	6	2
Steel Figures , hand cut, $\frac{1}{8}$ ", sets	1	1	1	1	1
Tapeline , 50' steel	0	1	1	1	1
Trammel Points , Adjustable metal frame, steel points.....	1	1	1	2	1
Turning Tools (For 12 lathes)					
Calipers, 6" inside and out-side, 12 each.....	0	0	24	24	24
Calipers, 12" inside and out-side, 1 each.....	0	0	2	2	2
Parting Tools, $\frac{1}{8}$ "	0	0	12	12	12
Round point, $\frac{1}{4}$ ", $\frac{1}{2}$ ", $\frac{3}{4}$ ", each	0	0	6	12	6
Spear point, $\frac{1}{4}$ ", $\frac{1}{2}$ ", $\frac{3}{4}$ ", each	0	0	6	12	6
Square point, $\frac{1}{4}$ ", $\frac{1}{2}$ ", $\frac{3}{4}$ ", each	0	0	6	12	6
Turning Chisels, $\frac{1}{4}$ ", $\frac{1}{2}$ ", $\frac{3}{4}$ ", each	0	0	6	12	6
Turning Gouges, $\frac{1}{4}$ ", $\frac{1}{2}$ ", $\frac{3}{4}$ ", each	0	0	6	12	6
Turning Skews, L.H. $\frac{1}{4}$ ", $\frac{1}{2}$ ", $\frac{3}{4}$ ", each	0	0	6	12	6
Turning Skews, R.H. $\frac{1}{4}$ ", $\frac{1}{2}$ ", each	0	0	6	12	6
Vise , 3" jaw, anvil face.....	1	1	1	1	1
Wrenches					
Adjustable, 8", 10", and 12", each	1	2	2	2	1
Headless Setscrew, $\frac{1}{4}$ " to $\frac{3}{8}$ " by 16ths, 1 each.....	0	0	7	7	7
Pipe, 10" and 12", each.....	0	1	1	1	1
S-type or open-end type to fit $\frac{1}{8}$ " to 1" U.S.S. nuts, each	0	0	1	1	1

Woodworking Supplies

20 to 25 Students Per Class

Name and Description	Elementary School	Junior High School	Senior High School	Technical High and Full-Time Vocational Schools	Part-Time Vocational School
Alcohol , gallons	4	4	8	8	4
Benzine , gallons	2	2	4	6	3
Brads , pounds					
$\frac{3}{8}$ " No. 20.....	2	4	8	8	3
$\frac{1}{2}$ " No. 20.....	2	4	8	8	3
$\frac{5}{8}$ " No. 20.....	2	4	8	8	3
$\frac{3}{4}$ " No. 19.....	3	6	15	20	5
$\frac{7}{8}$ " No. 20.....	3	6	15	20	5
1" No. 18.....	3	6	15	20	5
$1\frac{1}{4}$ " No. 16.....	3	6	15	20	5
$1\frac{1}{2}$ " No. 16.....	3	6	15	20	5
$1\frac{3}{4}$ " No. 15.....	3	6	15	20	5
2" No. 14.....	3	6	15	20	10
$2\frac{1}{2}$ " No. 14.....	3	6	15	20	10
Carbon Paper , black, sheets...	24	24	24	24	24
Colors , dry, 1-pound cans					
Burnt sienna	1	2	2	3	1
Burnt umber	1	1	4	5	1
Cobalt blue	1	1	1	1	1
Chrome yellow	1	1	1	2	1
Drop black	1	1	1	2	1

See classified directory for sources of supply

Name and Description	Elementary School	Junior High School	Senior High School	Technical High and Full-Time Vocational Schools	Part-Time Vocational School
Lamp black	1	1	1	2	1
Prussian blue	1	1	1	1	1
Raw umber	1	2	2	2	1
Van Dyke brown	1	1	2	2	1
Vermillion	1	1	1	1	1
Colors, Ground, in oil or japan, 1-pound cans					
Burnt sienna	1	1	2	2	1
Burnt umber	1	2	4	4	2
Cobalt blue	1	1	1	1	1
Chrome yellow	1	1	1	1	1
Drop black	1	1	1	2	1
Drop black, ground in japan.	3	3	5	5	3
Lamp black	1	1	1	2	1
Prussian blue	1	1	1	1	1
Raw umber	1	2	2	2	2
Rose lake	1	1	1	2	1
Van Dyke brown	1	1	1	3	1
Vermillion	1	1	1	1	1
Decalcomania Transfers			As required		
Dowels					
¼" hardwood, 3-ft. lengths, feet	50	50	100	100	50
⅜" hardwood, 3-ft. lengths, feet	50	50	50	75	50
½" hardwood, 3-ft. lengths, feet	50	50	50	75	50
¾" hardwood, 3-ft. lengths, feet	0	0	50	50	25
1" hardwood, 3-ft. lengths, feet	0	0	0	50	25
Dowel Pins and Plates			As required		
Enamel					
White, 1-pt. cans	2	2	2	2	2
Undercoater, 1-pt. cans	2	2	2	2	2
Fillers, Paste, pounds					
Natural	1	2	4	6	4
Golden Oak	1	2	4	6	4
Dark Oak	1	2	4	6	4
Mahogany	1	2	4	6	4
Fillets, leather, ¼" and ½"			As required		
Glue, hide, best grade cabinet, pounds					
Liquid, 1-qt. cans	50	50	100	100	100
	2	2	2	2	2
Hardware					
Such as brackets, buttons, butts, casters, catches, chain, chest corners, chest trimmings, corner braces, corner irons, corner plates, desk fittings, door fittings, escutcheons, fasteners, handles, hangers, hinges, hasps, holders, hooks, knobs, latches, lamp fittings, lid supports, locks, pulls, smoking-stand outfits, springs, stops, supports.			As required		
Hooks					
And Eyes			As required		
Cup			As required		
Screw			As required		
Square Screw			As required		
Lacquer, in 1-pt. cans					
Black	4	4	4	8	4
Clear	4	4	4	8	4
Cobalt blue	4	4	4	8	4
Ivory	4	4	4	8	4
Medium green	4	4	4	8	4
Red	4	4	4	8	4
Thinner	8	8	8	16	8
White	4	4	4	8	4
Yellow	4	4	4	4	4

Use post-card service for special information

Name and Description	Elementary School	Junior High School	Senior High School	Technical High and Full-Time Vocational Schools	Part-Time Vocational School
Lumber					
The following woods are used in school shops: Ash; balsa; bass; birch; cherry; cypress; locust; mahogany; maple; oak; poplar; red cedar; red gum; redwood; sap gum; yellow pine; walnut; white pine.					
In ordering pine, mill-run, kiln-dried will be found suitable for carpentry, while short select, kiln-dried 4" and wider, or No. 1 shop common, kiln-dried will be required for cabinetmaking and pattern-making.					
Hardwood, for furniture, should be specified first and second grade, kiln-dried, standard widths and lengths, or short lengths. (See pages 88-91.)					
Moldings					
			As required		
Nails, pounds					
Common, 6d	4	4	10	25	4
Common, 8d	2	4	10	50	50
Common, 10d	0	0	0	50	50
Flat Head					
1/2" No. 20.....	1	2	3	5	2
3/4" No. 19.....	1	2	4	5	2
1" No. 18.....	1	2	5	5	2
1 1/4" No. 16.....	1	2	5	5	2
1 1/2" No. 16.....	1	2	5	5	5
2" No. 13.....	1	2	5	5	5
Finishing, 4d	2	4	25	25	25
Finishing, 6d	2	4	25	25	25
Finishing, 8d	2	4	25	25	25
Oil, gallons					
Linseed, boiled	1/4	1	2	3	1
Linseed, raw	1/4	1/2	1	2	1
Machine	0	0	1	5	3
Rubbing	0	0	5	2	1
Overlay Carvings			As required		
Panel or Plywood			As required		
3 ply, 5 ply, 7 ply			As required		
Pattern Letters			As required		
Pins, Escutcheon			As required		
Pumice Stone, No. 0.....	3	5	10	10	10
Rapping Plates			As required		
Rottenstone	3	5	10	10	5
Sandpaper, reams					
Garnet, No. 1.....	1/4	1/4	1/2	1 1/2	1/2
Garnet, No. 1/2.....	1/4	1/4	2	3	1
Garnet, No. 0.....	1/2	1	1	1 1/2	1/2
Garnet, No. 2/0.....	1/4	1/4	1/4	1	1/2
Garnet, No. 3/0.....	1/4	1/4	1/4	1	1/2
Garnet, No. 4/0.....	0	1/4	1/4	1/2	1/2
Garnet, No. 6/0, wet or dry finishing	0	0	1/2	1/2	1/2
Garnet paper can also be obtained in rolls of 50 yd. each, and in widths 3" and up.			As required		
Screw Eyes			As required		
Screw Hooks			As required		
Screws, gross					
Flat-Head, brass					
3/8" No. 3.....	0	0	3	5	5
1/2" No. 4.....	1	1	3	5	5
5/8" No. 5.....	1	3	5	5	3
3/4" No. 5.....	1	3	5	0	0
3/4" No. 6.....	0	0	0	5	3
1" No. 8.....	1	1	5	5	3

See classified directory for sources of supply

Name and Description	Elementary School	Junior High School	Senior High School	Technical High and Full-Time Vocational Schools	Part-Time Vocational School
1 1/4" No. 10.....	0	0	0	5	3
1 1/4" No. 12.....	0	2	5	5	3
1 1/2" No. 10.....	0	2	5	5	3
1 3/4" No. 12.....	0	2	5	5	3
2" No. 10.....	0	2	5	5	3
Flat-Head, bright					
1/2" No. 3.....	0	0	0	5	5
1/2" No. 4.....	1	5	5	5	5
3/4" No. 6.....	1	5	5	5	5
1" No. 8.....	1	5	10	10	5
1" No. 10.....	0	0	0	10	5
1 1/4" No. 8.....	1	5	10	10	5
1 1/4" No. 10.....	0	0	0	5	5
1 1/4" No. 14.....	0	0	0	5	5
1 1/2" No. 10.....	1	5	10	10	5
1 1/2" No. 12.....	0	0	0	10	5
1 3/4" No. 10.....	0	0	0	5	5
1 3/4" No. 12.....	0	0	0	10	2
2" No. 10.....	1	5	10	5	2
2" No. 12.....	0	0	10	10	2
2" No. 14.....	0	0	0	10	2
2 1/4" No. 12.....	0	5	10	5	2
2 1/4" No. 14.....	0	0	0	10	2
2 1/2" No. 14.....	0	0	10	10	2
Oval-Head, brass					
3/4" No. 5.....	0	0	2	5	5
1 1/4" No. 10.....	0	1	2	5	2
Round-Head, blued					
3/8" No. 3.....	0	2	5	5	2
1/2" No. 3.....	1	2	5	5	2
3/4" No. 5.....	1	2	5	5	2
3/4" No. 6.....	0	0	0	5	3
1" No. 8.....	1	2	5	5	2
1 1/4" No. 10.....	0	0	0	5	2
1 1/2" No. 10.....	1	2	5	5	2
1 1/2" No. 12.....	0	0	0	5	3
Round-Head, brass					
3/8" No. 2.....	1	3	5	5	5
3/8" No. 3.....	1	3	5	5	2
1/2" No. 4.....	1	3	5	5	2
5/8" No. 3.....	1	2	5	5	2
3/4" No. 5.....	1	3	5	5	2
Shellac					
Orange, cut 4 pounds to the gallon, 1/2-gal. cans.....	4	6	10	10	4
Sticks, assorted colors.....	12	12	24	24	24
White, cut 4 pounds to the gallon, 1/2-gal. cans.....	4	6	10	10	4
Note: Shellac should be kept in glass or earthenware containers.					
Stains, Oil, spirit or water, quarts.					
Fumed Oak	0	0	3	6	3
Dark Oak	0	0	3	6	3
Golden Oak	1	2	3	6	3
Light Oak	1	2	3	6	3
Mahogany	1	2	3	6	3
Walnut	1	2	3	6	3
Steel Wool, 1-lb. packages					
No. 0	0	0	4	4	4
No. 00	0	2	4	4	4
Turpentine, gallons	2	4	5	5	2
Twine, balls	0	6	6	6	6
Varnish, 1/2-gal. cans.....					
Flat	2	4	4	4	1
Remover	0	0	2	2	2
Rubbing	2	4	8	10	3
Waste, pounds					
Cotton, white	50	50	100	100	100
Wax, pounds					
Bees	0	0	5	10	5
Finishing	2	5	8	10	5
White Lead, pounds	0	25	25	25	25

Use post-card service for special information

Hardwoods in the Schools

Ervin R. Edgcomb

Some of the advantages of hardwoods for school use may be listed as follows:

- a) Contrary to the general impression, most hardwood is comparatively easy to work.
- b) Most of the hardwoods are of even growth, and consequently plane smooth and sand well.
- c) Each hardwood has its own peculiar characteristic grain, lending itself particularly to some special use or effect.
- d) The use of hardwoods permits the possibility of a finer finish on the article than where softwoods are used, and at the same time the beauty of grain can be utilized.
- e) The increasing use of hardwoods in schoolwork gives a fine opportunity to teach the important art of wood finishing.

In addition to the foregoing, there is an increase in pride of workmanship, on the part of the student, who is likely to take much more pains when using walnut or mahogany than when he is working with cheap wood. The additional cost of the high-class hardwood in a small cabinet or chair, however, is trifling, perhaps not more than 40 or 50 cents.

The increased interest of the students in their work naturally stimulates the interest of their families in the whole scheme of industrial-arts education.

The domestic hardwoods most frequently used are the following:

White Ash. This wood, which has been used since the early Colonial days, ranges from the southern Mississippi Valley and Texas to the northern part of New York and New England. The Northern Ash has long been noted for its strength and toughness and has been used in the wheelright trade, for automobile tops, and for similar uses where strength and toughness is required. The Southern Ash, while not so tough, is still quite strong. It is obtainable in good widths and lengths and hence is used very largely in automobile-body building, coach work, car building, butchers' fixtures, and many other uses, including the industrial arts.

Basswood. This wood, called "Lynn" in some parts of the south (a corruption of the European "Linden"), grows in West Virginia, North Carolina, northern Georgia, and Tennessee, and as far north as Canada. It is a soft hardwood, considered by lumbermen a *hardwood* on account of it being a deciduous tree. It is, nevertheless, exceedingly soft and very easy to work. It is very light and yet quite tough. Basswood is used for house trim, picture molding, trunk boxes, and other places where its even grain, easy working qualities, and lightness are of advantage. Basswood is not considered durable when exposed to the weather, though much of it has been satisfactorily used, when well painted, for house siding.

Chestnut. The former range of chestnut was from central Georgia and Tennessee, northward to Massachusetts. Due to the destruction caused by the chestnut blight, imported from China, it is now produced principally in West Virginia and North Carolina. Practically all the chestnut in the north is already dead or badly infected by the disease. Chestnut is light in weight, easy to work, quite porous, very lasting, resists rot well, and is one of the most useful of the domestic woods. It has in the past been used very largely for house trim, casket work, exterior use, etc. As a considerable proportion of the chestnut timber is wormy, a large use has been built up for this particular grade in cores, which are later covered by mahogany, walnut, or some other high-class wood. It makes an excellent core wood, as the porosity of the wood gives a good anchorage for glue; and the wood when thoroughly dry, is very durable.

Birch and Maple. These two woods range from the high altitudes of North Carolina and West Virginia, north into Canada. Considerable maple was used in Colonial days for ordinary house furniture. It is exceedingly hard, close-grained, and when selected in straight-grained wood, is very strong. Large quantities are used for flooring.

Birch is used very largely in trim, being a close-grained wood, which takes paint and enamel very well. It is also used to a certain extent for flooring, though not as extensively as maple.

The principal supplies of maple and birch at the present time lie in the Adirondacks in New York state and in Wisconsin and Canada, though a considerable quantity is still produced in Pennsylvania, West Virginia, and North Carolina. Neither birch nor maple is very durable when exposed to the weather.

Poplar (Whitewood). The range of this wood runs from Georgia and northern Alabama, north as far as Massachusetts and central New York. The major portion of the present production comes from North Carolina, West Virginia and Tennessee, all of which sections produce the soft, mountain poplar. A very good grade of poplar, but of somewhat harder texture, also is produced as far south as southern Georgia and central Alabama. The poplar of the north has been largely cut off and the production from this section at the present time is small. This wood, like basswood, is a soft hardwood, being of a yellowish color, with an even, close grain, but light, soft, and easy to work. Poplar is used largely in trim, certain parts of cabinetwork and is also used quite largely in house siding where it has given excellent satisfaction when properly painted.

In addition to the above uses, poplar has one or two places where its peculiar qualities give it exclusive command. For instance, it has been used for many years in the manufacture of the blocks on which felt hats are shaped and ironed. Other woods have been used for this purpose but not with entire success.

Black Walnut. This fine native wood ranges from West Virginia and Tennessee, northward to the Canadian line. While the old virgin growth of walnut is largely gone, a considerable quantity is still marketed and it is in high favor for fine cabinetwork, paneling, etc. The fact that the virgin growth of this wood is almost extinct, has reduced the supply to a point where prices have advanced so that this wood is now bringing considerably more than mahogany of like grade and texture.

Due to the extravagant and wasteful methods of lumbering, our domestic hardwood forests are very largely gone.

While much is now being accomplished in reforestation, it will be many years before we again have an abundant supply of our best domestic hardwoods, and many users are looking to various tropical woods to supply their needs in the meantime.

The principal tropical woods which have so far come into the American markets for use as lumber are as follows:

Spanish Cedar. This wood grows in a wide range of country running all the way from the valley of the Amazon, north to Mexico. The wood has a grain resembling mahogany and much of it has somewhat the color of mahogany as well. It is most generally known to the public in the form of cigar boxes. The fact that the wood has a pungent and pleasant odor, may also be one of the reasons why it has been adopted for use in cigar boxes. The wood is generally very soft, easy to work and seems particularly suitable for this use. It has not been imported in the form of lumber in any large quantities, though it is sometimes used in boat building, particularly for fine racing shells where its light weight and handsome appearance makes it desirable. A considerable quantity is also used in tennis-racket handles where its light weight, combined with the fact that it can be "combed" without raising a stringy grain, makes it of particular value. Its cost is about equal to that of Mexican mahogany.

Teak. Teak is produced only in the East Indies and India. It has been used for many years in shipbuilding, where it is, without question, the premier wood. The wood is brown in color and most of it is not particularly hard, being, roughly speaking, of the hardness of domestic oak or ash.

While the wood works easily, it is said to carry a silicate deposit which sometimes dulls the tools. However, it is generally preferred by high-class ship carpenters to almost any other wood, except possibly mahogany, for rails, decking, outside trim, paneling, etc. The wood is naturally filled with a sort of wax which can be readily felt by rubbing a smooth, freshly cut piece with the finger. This substance renders the wood almost weatherproof and it is generally conceded to be one of the best rot-resisting woods.

In addition to ship work, it is used also for fine cabinet-work, parquet flooring and other uses. The supply is largely controlled by the English and Dutch governments and the price is approximately 70 to 80 per cent higher than that of Mexican mahogany.

Teak planted over 100 years ago by the Dutch Government in Java is now being harvested. This is a fine example of the foresight practiced by the Dutch people.

Java teak is darker and heavier than that of India and is more frequently used in furniture and parquet flooring. The Indian teak, while softer, comes in longer lengths and is preferred in ship work.

Mahogany. The first authentic record of the use of mahogany dates back to about 1587. History records that Sir Walter Raleigh had one of his ships badly damaged in a storm off the coast of the West Indies. This ship was repaired with wood from a tree having the native name "mahogoni." From this circumstance, the name mahogany was brought on the market. The wood thus introduced, soon became popular in England where it was used largely in fine furniture. This was the original genuine mahogany, and is the standard from which all the other mahoganies have been judged as they came on the market, one after another.

While experts list about fifty or sixty varieties of commercial mahoganies, the chief species recognized in the lumber market are the following.

Cuban and San Domingan Mahogany. These, together with the Jamaican, are the old original genuine mahoganies of our ancestors. From the original importation up to about 1700, this wood went to England and Europe, largely as ship ballast. By 1700 its importation had grown to 300,000 ft. per year. The use of the wood steadily expanded, but at the present day the supply of accessible timber is so small that the importations of this old genuine original mahogany now constitute less than 1 per cent of the total imported and sold in the United States.

Cuban and San Domingo mahogany are about as close grained as birch, and of approximately equal weight: viz about 3½ to 4 lb. per board foot when kiln-dried.

Mexican or Honduras Mahogany. The next mahogany to come on the market was the wood now sold under the inclusive term "Central American" or more frequently "Mexican Mahogany" or "Honduras Mahogany." The woods now marketed under this name come from Mexico, Honduras, or Nicaragua, as well as some from Panama. As these woods come from a wide range of country, they naturally vary from the soft baywood of the swamps to the firm-textured wood of the higher lands. Generally speaking, Mexican mahogany as found on the market is a fairly close-textured wood, moderately light in weight, easy to work, and obtainable in good grades, but sometimes lacking in grain and figure. These woods first came on the markets of the United States about 1870. They vary in weight from 2½ lb. to 3½ lb. per board foot, when kiln-dried.

While it is not the genuine "Swietenia mahagoni" and when first introduced was not regarded as genuine mahogany by many users of that day, it is now generally accepted by botanists and lumbermen alike as a true mahogany, as it carries the general characteristics (though somewhat modified) of the old original mahogany. It is largely used in furniture work, house trim, certain grades for patterns, caskets, molding, etc.

African Mahogany. Under the term "African mahogany" there come on the market several woods from western Africa. These woods have been obtainable in the United States markets for about 35 years. While none of them are members of the "Swietenia" group, and are, therefore, not entitled to the term "mahogany," on a strictly botanical basis, they are generally accepted by the lumber trades as one of the commercial mahoganies. These woods, while more cross grained and inclined to figure than the average Mexican mahogany, and said to be harder to finish, are highly thought of for use in figured panels, figured surfaces in furniture, as well as other uses. The price of African "mahogany" is approximately 15 to 20 per cent less than the Mexican variety. Its weight when kiln-dried approximates that of the Mexican and Honduras woods.

Philippine Mahogany.¹ For some twenty years there has been imported and sold under the term "Philippine Mahogany," wood from the Philippine Islands. This wood has the general characteristics of mahogany, including the typical

mahogany grain, and was therefore introduced on the market by the lumbermen under the name "Philippine Mahogany."

The Philippine wood is moderately light, weighing in the best grades about 3 lb. per board foot when kiln-dried. It is easy to work and shows a handsome grain. It can be obtained either in plain wood or in the quarter sawed which shows a ribbon stripe. Due to the large virgin growth, it is possible to obtain wide, clear stock, such as was obtainable when Sir Walter Raleigh made the first importation of the original *Swietenia mahagoni*.

The Philippine, unlike either the Mexican or African woods, grows in a heavy stand comparable to our western forests. This permits the use of American machine-logging methods, which accounts for the lower price at which this wood is sold. As this wood is grown under the American flag it pays no duty, and being manufactured into lumber at the point of production, sells, grade for grade, at about 65 to 75 per cent of the price of the Mexican or African woods.

The Philippine variety is generally used for certain types of furniture, patterns, caskets, house trim, bank and office fixtures, doors, electrotype blocks, cabinetwork, and very largely for fine boat construction.

In the latter work it is used, not only for planking, decking, and cabin trim, but due to the strength² and durability of the wood, for keels, chines, and frames as well. Much is used in thin stock, such as ¼, ⅜ and ½ in. for planking the popular little outboard motor boats, a use where strength, lightness, and screw-holding qualities are important. The Philippine wood, while more porous than the Mexican variety, and somewhat lighter in weight, appears to have the peculiar quality of absorbing less water when submerged than either the Mexican or African woods.

Peruvian Mahogany.³ This fine cabinet wood growing on the headwaters of the Amazon and the high Eastern slopes of the Peruvian Andes has only recently come on the market in any quantity. It is said to be, botanically, a true mahogany, but aside from the shape of the leaf and flower presents the well-recognized characteristics that in the minds of the lumbermen and users of fine woods spell "mahogany."

While not as heavy as the old original mahogany (Cuban or San Domingan), it is slightly heavier than the Philippine, Mexican, or African woods. The claim is made by one importer of tropical woods that Peruvian mahogany resembles more closely the original mahogany in texture and appearance than any other variety now on the market.

It is particularly adapted to chairs, fine furniture and similar work where hardness and ease of finish is desired.

The wood sells at approximately the same price as Mexican mahogany. In some cases, due to its being a late-comer on the market, it sells for slightly less than the longer-established Mexican mahogany. Its weight, kiln-dried, averages about 3¼ lb. per board foot.

Mahogany Nomenclature. There has been considerable litigation by the Federal Trade Commission in an endeavor to force the lumber trade to sell various woods, such as some of the commercial mahoganies, California white pine, Australian walnut, etc., under names in strict accordance with their respective botanical classifications.

Inasmuch as a botanical classification (which is based solely upon leaf, flower, and fruit of the tree) does not necessarily insure certain definite characteristics in the wood from a given tree, the lumbermen generally prefer the classifications and names which have grown up through years of usage in the lumber trade and lumber-using industries.

As this matter has not been definitely settled, the great majority of the dealers throughout the country continue to sell these commercial mahoganies as such, usually coupling the name of the country of origin with the term "mahogany" so that every one concerned may understand exactly what is being sold.

Imbuia (Brazilian Walnut). This wood, while not botanically "Juglans," the term used by botanists to cover our American black walnut and butternut, presents in many pieces a typical walnut grain and color. It is, if anything,

¹While not generally regarded as a particularly strong wood it is claimed that in the better grades this wood is stronger, weight for weight, than oak.

²A useful grade in Peruvian mahogany for school use is known as "clear shorts," ordinarily obtainable in 1 to 2-in. thicknesses and handled by some lumber firms, specializing in school trade, in thicknesses as thin as ¼ in. D2S. This grade is 4 in. and wider, largely 6 in. to 10 in. and in length runs from 2½ ft. to 5½ ft.

³Considerable quantities of this wood are sold also under the registered trade name "Philippine Indoako Wood." (See paragraph on mahogany nomenclature.)

a trifle harder and closer grained than our American walnut. It cuts clean and is very easy to finish. Its color varies from a yellowish brown to the reddish brown of American walnut. Very attractive contrasts in color and grain are obtainable. The importations to date have been small but indications point to the possibility of a considerable development in the next few years. It is suitable for fine cabinet-work where hardness and ease of finish are paramount, particularly where a comparatively light color is desired. Prices are 20 to 30 per cent under American walnut.

Balsa. This unusual wood first came to the notice of the United States markets about 1917. It grows wild in Costa Rica, Nicaragua, Columbia, and Ecuador, as well as in various other sections of the tropics. The major portion of the wood now being imported, however, comes from Ecuador. Its unusually light weight is startling when one sees it for the first time.

In color and general appearance, the wood resembles the native basswood, one of our lightest woods. In weight, however, the basswood is about five times as heavy as Balsa, which weighs, when kiln-dried, approximately $\frac{1}{2}$ lb. per board foot. It is very soft as well as light and is used for insulation against heat, isolation of delicate machinery from vibration, bumpers, used instead of felt and similar substances in packing radios and other delicate mechanisms. In addition, its light weight makes it desirable for aquaplanes, surf boards, etc., as well as for stream lining airplanes. In schools it is generally used for toy airplanes as well as to some extent for scale models of various kinds cut from the solid block. Like ordinary lumber, it is obtainable in standard thicknesses, 1 in. and thicker. Lengths run from 3 ft. and up, and widths from 3 or 4 in. to 8 or 10 in. It is said to be the fastest growing tree living, specimens having been noted which have grown to over 20 in. in diameter in five years.

Veneers. In the minds of the general public, a veneered article is thought to be in some way inferior. This is quite contrary to the real facts, as almost invariably a veneered article of furniture is better than one made of solid wood. Solid wood, no matter how carefully dried, under our modern conditions of heating is very likely to check, shrink, and warp, whereas the same article if built up of layers of veneers carefully glued together, will stay straight and remain in place. There are a number of different methods of making veneers.

Sliced Veneers. In this case the log is cut into "flitches" which are simply thick, heavy planks cut out of the log at the proper angle to show the best figure. These flitches are cooked in a steam tank to soften the wood and are then fastened on the slicing machine. The machine is started and the flitch is drawn back and forth across the surface of an immense knife, which, at each turn of the machine, cuts off a sheet of veneer of the proper thickness.

Rotary-Cut Veneers. In this case, the sections of logs, after being cooked, are fastened into an immense lathe-like machine which shaves off a thin sheet of veneer as the log revolves. There is also another method called the "half rotary," which is somewhat similar to the rotary.

Sawn Veneers. These veneers are sawn from flitches on what is known as a "segment saw." This is a heavy saw frame and husk, to the rim of which are fastened segments of very thin blades. The flitches are carried back and forth past this saw on a carriage somewhat resembling the regular carriage in a sawmill. The veneers manufactured by this method are considered superior to any of the other types, as the wood is not crushed in any way during the process of manufacture and, consequently, tends to lie flat and stay in place.

Grades of Lumber

Grading. There appears to be considerable confusion in the minds of many hardwood users concerning the methods of grading. Formerly there was a large variation in the grades put out by different concerns and manufacturers in different localities. Of late years, however, practically all of the grading has come under the supervision of the National Hardwood Lumber Association. This Association was formed nearly thirty years ago with the sole object of securing uniform hardwood inspection. It has been so successful in this that "National Rules" are generally accepted, not only by individual buyers throughout the hardwood trade, but by exporters and by the United States Government as well.

The three principal grades of hardwoods are:

Firsts and Seconds. Sometimes written "1st & 2nd," "1s&2s," or "Fas," usually 6 inches and wider, 8 feet and longer.

This is a combined grade and is the best grade in hardwoods recognized under the National Rules. Roughly speaking, this grade, when put up by the best houses, is nearly clear. It should be noted that the pieces described in the National Rules are the poorest pieces admitted in the respective grades.

No. 1 Common. This is the second grade of hardwoods, usually 4 inches and up in width and 6 feet and up long. Roughly speaking, this grade cuts two-thirds clear cuttings with limitations as to size of cuttings allowed.

No. 2 Common. This is the third grade of hardwoods, usually 3 inches and wider, and 4 feet and longer, and cutting roughly 50 per cent clear face cuttings. The size of the cuttings allowed is limited by the Rules.

As over nine tenths of the hardwood used for school-work is required in "1s&2s" we give below a schedule showing the number of standard defects permitted in various-size pieces of 1s&2s. As it would be impossible to show all details of the Rules in chart form, this schedule is necessarily incomplete. For complete grading instructions covering all grades and kinds of hardwoods, the national inspection rules should be consulted. These can be obtained for 10 cents each on application to the National Hardwood Lumber Association, 2008 Straus Bldg., Chicago, Illinois.

Measuring Lumber. All stock under 1 in. is measured as if it were 1 in., even if veneer as thin as a piece of paper. This method sometimes leads to misunderstanding on the part of people unfamiliar with the customs of measurement used in the trade. For instance, a buyer may order 1000 board feet of $1\frac{1}{4}$ in. resawed in the center, expecting to get 2000 feet of thin stock. He is shocked on measuring up his thin boards to find that instead of the 2000 ft. expected, he has about 1600 ft. If he will consider the yield of a single typical board when resawed, he will see the reason for the apparent shortage.

For instance, one piece of $1\frac{1}{4}$ in. by 12 in. by 12 ft. contains 12 surface feet which, with $\frac{1}{4}$ added to the 1-in. measure, gives 15 board feet as the contents of the board. This, when resawed, gives (allowing nothing for the saw cut) two pieces, each $\frac{1}{4}$ in. by 12 in. by 12 ft. Inasmuch as anything thinner than 1 in. carries 1-in. measure, each of these pieces contains 12 board feet or a total of 24 ft. from 15 ft. of $1\frac{1}{4}$ in. resawed once. Similarly, a $1\frac{1}{2}$ -in. plank by 12 in. wide and 12 ft. long containing 18 board feet produces two pieces each thinner than 1 in. and containing a total of 24 ft. A piece of 2 in. by 12 in. by 12 ft. long containing 24 board feet, however, resawed into two pieces, still produces 24 board feet. A piece of 1 by 12, 12 ft. long contains 12 board feet. When resawed once, it produces two pieces totaling 24 ft.

Dryness. This all-important question is back of more lumber troubles than almost all other factors put together. In the old days when steam heat had not yet been dreamed of, and while the low cost of even the finest hardwoods made it possible to tie up the investment in the lumber for a leisurely air-drying of two, three, or four years, it may have been practicable to use air-dried hardwoods. Our forefathers, however, had no steam heat. Had they had, we are inclined to believe they would have devised some method of kiln-drying, as it is certain that no air-dried lumber will stand steam heat without shrinking, that is, unless it has been dried under such conditions as to be practically kiln-dried.

"Air-dried" runs from shipping dry (three months on sticks) with a probable moisture content of approximately 20 to 25 per cent to one year or better running down to 12 to 15 per cent. "Kiln-dried" lumber can be had as dry as 5 per cent. Best results are generally obtained from about 6 to 8 per cent.

Advantages of Kiln-Drying. The small extra cost, usually $1\frac{1}{2}$ to 3 cents per board foot, according to thickness, is small when considered in the light of the advantages, some of which are as follows:

1. Kiln-drying secures *uniformity of dryness* through each piece and also between different pieces of the same lot.
2. Kiln-dried lumber reduces to a minimum the *danger of shrinkage* after working.
3. Kiln-dried lumber planes easier and smoother.
4. Kiln-dried lumber sandpapers smoother and takes filler and other finishes more readily.
5. Kiln-dried lumber will resaw with less warping and twisting.

STANDARD DEFECTS CHART													
This chart shows the number of standard defects, or their equivalent, which are allowed in the various sizes of 1s-2s in the various hardwoods which are commonly used in school shops. The inspection is always from the poor face of the piece of lumber. The chart is compiled according to the 1929 National Inspection Rules. A standard defect is theoretically equal to the damage done by a knot, 1 1/4 in. in diameter.													
NAME OF WOOD	Surface Feet					Widths in Inches	Lengths in Feet	Short Lengths Allowed		Remarks			
	5 to 7	8 to 11	12 to 15	16 to 19	20 and over			Per Length in Feet	Lengths in Feet				
Ash, beech, birch, hard maple	1	2	3	4	5	6 and over. 5" may be 5" if it is clear.	8 to 16	30	8 to 11	6" straight split or equivalent is no defect. Slight wane is no defect.			
Basswood, soft maple, buckeye chestnut	1	2	3	4	5	6 and over. 5" may be 5" if it is clear.	8 to 16	25	8 to 11				
Plain oak	1	2	3	4	5	6 and over. 5" may be 5" if it is clear.	8 to 16	25	8 to 11	Bright sap is no defect if it is on one side only. 1" bright sap on face no defect. Each additional 1" sap equals 1 standard defect.			
Quarter-sawn oak	1	2	3	4	5	6 and over. 5" may be 5" if it is clear.	8 to 16	25	8 to 11	1" bright sap is no defect. Each additional 1" sap equals 1 standard defect. 10% may be slightly scant in thickness on one edge. The figure must show on 90% of the face on all boards.			
Plain red gum	1	2	3	4	5	6 and over. 5" may be 5" if it is clear.	8 to 16	25	8 to 11	1" sap on one face, and 1/5 of reverse side sap is no defect. Sound sap stain admitted.			
Quarter-sawn red gum	1	2	3	4	5	5 and over. 5" pieces must be clear.	8 to 16	25	8 to 11	10% may be slightly scant in thickness on one edge. 5" pieces must be free from sap on 1 face; 6" and 7" pieces, 3/4" sap on face is no defect; 8" and over, 1" sap is no defect. All pieces may have sap equal to 1/5 of reverse side.			
Cherry	1	2	3	4	5	6 and over. 5" may be 5" if it is clear	8 to 16	25	8 to 11	1" bright sap on one side is equal to one standard defect. Gum spots, if excessive reduce a piece in grade.			
Mahogany, (Mexican, African, and Philippine)	Surface Feet					6 and over. 5" may be 5" if it is clear	8 & Over	25	8 to 11	1" bright sap equal to one defect. Owing to fineness of worm holes in Philippine mahogany, only those visible in the rough lumber to the naked eye are to be considered. Some dealers of this variety have a grade which they guarantee to be free of worm holes.			
	6 to 8	9 to 12	13 to 17	18 & Over									
Walnut and butternut	Lengths in Feet					6 and over. 5" may be 5" if it is clear	8 & Over	55	8 and 9	Odd lengths without limit.			
	8 and 9		10 to 13								14 & Over		
	Widths in Inches												
	6&7	8&9	10&over	6&7	8&9						10&11	12&over	6&7
	1 & 3/4 in. sap	1 & 3/4 in. sap or 2" def. or 2" sap	2 & 2" sap or 3" sap	1" sap	2" sap						3 & 2" sap or 2 and 3" sap	3 & 3" sap or 4" sap	2 & 1" sap
Poplar (Whitewood)	Widths in Inches					6 and over. 5" may be 5" if it is clear and 10 ft. and longer.	8 to 16	25	8 to 11	In 10" to 17" widths, bright sap aggregating to 1/3 the width of the piece is permitted. Each additional 1" to be considered 1 standard defect. On the reverse side 1" bright sap is permitted, each additional 1" to be considered a defect. Bright sap permitted without limit in pieces 18" and wider.			
	6	7	8 and 9		10 and wider								
	Surface Feet												
	5-7	8&over	6-9	10-14	15-20						21&over		
	Clear	1" br. sap	1" br. sap	1 & 1" br. sap, or 2" br. sap	1	2	3	4					

Standard Thickness of Hardwoods. In the rough, $\frac{3}{4}$, $\frac{1}{2}$, $1\frac{1}{4}$, $1\frac{1}{2}$, 2, $2\frac{1}{2}$, 3 and 4 in. Formerly $\frac{1}{8}$ in. was allowed for dressing each side, which meant that 1 in. rough-dressed two sides to $\frac{3}{8}$ inch, $1\frac{1}{4}$ in. D2S to $1\frac{1}{8}$ in. etc. However, in line with a movement for conservation of forest resources, many hardwood concerns have changed their dressed sizes to permit of slightly closer cutting and now make $13/16$ in., the dressed thickness of 1 in., $1\frac{1}{8}$ in., the dressed thickness of $1\frac{1}{4}$ in., etc.

It is generally customary in the hardwood trade to write 1 in. as $4/4$ in., $1\frac{1}{4}$ in. as $5/4$ in., $1\frac{1}{2}$ in. as $6/4$ in., etc. Either method is correct. In specifying certain dimensions, it is usual to mention thickness, width, and length in this order; i.e., 1 piece 1 in. by 10 in.—16 ft. D2S $\frac{7}{8}$ in. (or $13/16$ in.).

Trade-Marked Lumber. Comparatively little lumber sold, either soft or hardwood, is trade-marked. There is a movement in this direction in the lumber trade, particularly in the softwood field. We understand that at least one large dealer in fancy woods is already offering trade-marked stock to the school trade. This particular trade-mark carries a guarantee to replace without charge, any trade-marked lumber found to be under grade. This is a progressive move which other concerns will no doubt follow.

Buying. The necessity of buying only from reputable and trustworthy dealers cannot be too strongly urged. One of the disadvantages of the competitive-bid situation is the

fact that, generally speaking, price is the sole governing factor in awarding the business, and too frequently the unusually low bidder later attempts to make up either on the grade of stock furnished or on the quantity. Therefore, as a general proposition, it is well to scrutinize with care the excessively low bidder, both as to grades proposed to be furnished and particularly past performances. In some schools it is possible to set up a list of responsible bidders and to bar from this list, concerns whose stock proves consistently unsatisfactory. If for any reason it is impractical to do this, the following suggestions may be helpful in check-mating any possible effort to furnish improper grades or measurement.

Insist that each piece of hardwood delivered be marked with lumber crayon showing the number of board feet, 1-in. measure, charged for on each board. If this is done, the marks can easily be tallied as received and any possible mismeasurement located and localized without the necessity of remeasuring the entire lot. The measurement should be checked promptly on delivery and any claims of errors made while the entire lot in question remains intact.

Have your deliveries made so as to permit of careful checking of the measurement and grade as the stock arrives. Buy your lumber on National Rules. This can be accomplished by simply specifying "Grading to be according to National Inspection."

Oliver Machinery Co.

Grand Rapids, Mich.

Branch Offices in Chicago, Los Angeles, Minneapolis, New York, St. Louis, San Francisco

Salesmen or Agents in Other Principal Cities

Manufacturers of

Woodworking Machines and Machine Tools

It is impossible to list the complete "Oliver" line here, much less give complete specifications. We have chosen those which find widest application to the various school uses. All "Oliver" Machinery will meet the exacting requirements of industry or the school shop. All "Oliver" Machines are built to the same high standard of quality, any difference in price being incidental to size rather than differences in workmanship or material.



Over 2000 Schools
Use "Oliver" Tools.

We are confident we can meet every requirement imposed by particular shop conditions. If none of the machines described in this abbreviated list meets with your requirements, write for specifications on our other types. "Oliver" Machines have made enviable records for production accuracy, economy and long life. They merit your consideration. Specifications here are most meagre. Send for complete descriptive literature.

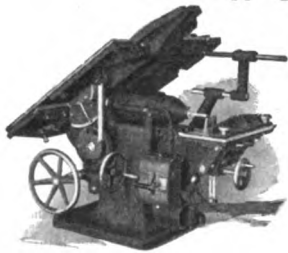
No. 88 Tilting Motor-Arbor Miter Saw

Motor-arbor drive and permanently horizontal table—entirely self-contained. Either plain table or universal table with rolling section. 5 H.P. ball bearing motor mounted directly on saw arbor; tilted to any angle by means of handwheel; rigidly locked by hand lever. Totally enclosed push button control; all wiring furnished. Thoroughly safeguarded. Adjustable splitter blade. Sawdust directed into exhaust compartment. Overhead cage guard for exposed blade. Maximum convenience further promotes safety. Every control immediately accessible from normal operating position. Takes 14" to 18" saws and dados up to 12"x2", and will do all practical miter or dado work.



No. 80 Variety Saw Bench

Universal Table, 38½"x44½"; Plain Table, 36"x44"; tilts to 45 degrees. Rips up to 23" wide and cuts off 36" wide on universal ripping table. Rips 27" wide and cuts off 15" wide on plain table. Cuts up to 3¾" thick with 16" saw or 2¾" with standard 14" saw. All this, and perfect mitering, it does without operator doing previous calculating or even referring to a rule. With mortising and boring attachment (extra) it will bore 2" holes 6" deep and mortise up to ¾" square and 4" deep. Choice of plain or universal table. Ball bearing throughout. Special safety features. The ideal school machine.



No. 32 Motor Head Variety Saw Bench

Saws 2½" stock. Will rip up to 18" wide; cross cut to 13". Takes Dado head 10" diameter and 1" wide. Table, 33"x34" tilts 45°; vertical adjustment 3". 2 H.P., 3600 R.P.M. ball bearing motor-on-arbor with enclosed safety switch. Includes 12" hollow ground miter saw, "no kick back" guard, splitter blade, two miter gauges with connecting yoke, adjustable tilting ripping gauge, clearance block, filling strips for table slots, arbor wrench. Conduit wired ready for use. An exceptionally compact, high quality, safety machine.



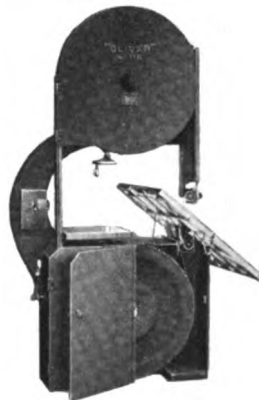
No. 191 Tilting Arbor, Motor-Driven Saw Bench

Cuts 2" deep with 7" saw or 2½" deep with 8" saw. Takes ⅞" Dados. Capacity between blade and fence, 12". Speed of arbor, 5200 R.P.M. Table 25"x30", always level. Cut off gauge or fence may be used either side of saw. Removable aluminum throat plate. Saw arbor tilts by means of self-locking hand wheel; angle of tilt indicated. ½ H.P. motor drives through guarded endless belt. Tumbler switch may be "locked off." Aluminum saw guard and steel splitter blade.



No. 116 36-Inch Band Saw

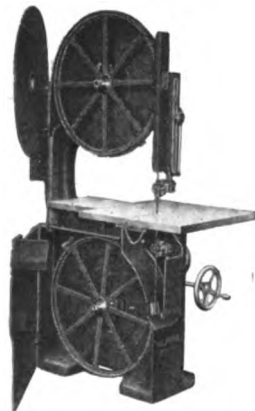
Frame and base one piece. Rubber faced aluminum rimmed steel clad disk wheels or one piece spoke wheels. Both wheels guarded by steel doors. Back blade fully enclosed by metal guard—front by U-shaped guide post. Hand brake (when supplied) stops blade quickly. The safest saw made. Height of cut under guide, 22", 36" swing to column; speeds usually 600 or 900 R.P.M. Upper wheel has 9" vertical adjustment and micrometer tilt adjustment. Frictionless roller guides and steel side guides. Table is ground to make operation easier. Table is 36" square mounted on two machined rockers, tilts 45° right and 7° left. Auxiliary table 16½"x15". Motor-on-shaft drive recommended.



No. 117 30-Inch Band Saw

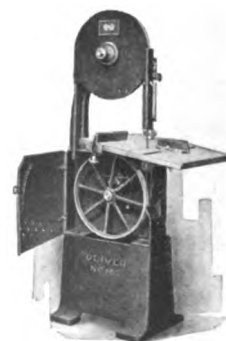
Motor arbor drive. One piece frame and base. Takes 29½" between saw and rear guard; 15" below guide. Ground table is 26"x28" and tilts 45° right and 10° left by means of handwheel and self-locking worm and segment.

Auxiliary table, 16"x14". Takes blades ¼" to 1½" wide. One piece machined wheels run on ball bearings. Upper wheel raises and lowers in gibbed dovetailed ways and tilts by means of micrometer screw; fitted with springs and indicator to show tension. Counter-balanced guide post acts as front guard. Ball bearing roller guides with steel side guides. Entire blade guarded except at the cut; all wheels fully enclosed. The most fully guarded band saw made.



No. 192 18-Inch Band Saw

A motor-arbor band saw with all essential features of larger "Oliver" machines. Takes 18" between saw and column; 8" under guide. Uses saws up to ½" wide. Will rip up to 11" wide and cross cut and miter up to 8" with gauges. 24"x20" table tilts right 45°; carries ripping fence and miter cross cut gauge. Machined, balanced wheels turn 900 R.P.M. on ball bearings. Upper wheel has 4" vertical adjustment and micrometer tilting screw. Wheels and blade fully guarded. Guide post acts as front guard. Two ball bearing roller guides with steel side guides. Complete with motor-arbor drive, cord, and plug and push button switch.

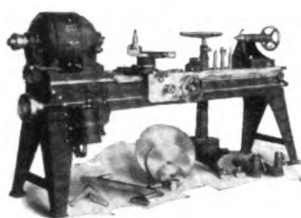


Oliver Machinery Co., Grand Rapids, Mich.

Oliver Machinery Co., Continued

No. 25 Motor Head Pattern Lathe

Built for A.C. or D.C. Fully enclosed, variable speed, 2 H.P. D.C. motor. 20 changes, 400 to 2000 R.P.M. with C-H drum controller, or 3 H.P. four-speed 600, 1200, 1800, 3600 R.P.M. A.C. motor, ball bearing enclosed with suitable control. Open side tailstock. Spindle bored to No. 4 Morse taper. Broad, flat-top bed with carriage ways cast to side. Belt driven power-feeding carriage or handfeed if desired. Graduations on bed. Swing, 16". Swing over carriage, 13". Length will turn between centers, 60". Length of bed, 8'. Height, bed to floor, 34". Travel of carriage, 5' 3". Full equipment. Faceplates, chuck, rests, tool holders, centers, floor stand, etc.



No. 51K Adjustable Speed Lathe

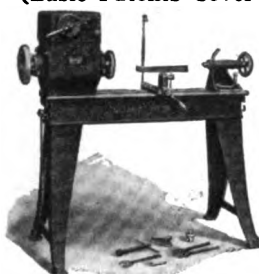
(This adjustable speed motor has basic patents.)
The Premier Motor Head Speed Lathe

It operates on single phase and when properly connected operates from two or three phase alternating current. (When built for direct current it is called No. 53.) Speeds Adjustable—any speed from 600 to 3600 R.P.M. Totally enclosed. Push button start and stop. Sensitive speed control through convenient handwheel regulating enclosed governor. Ball bearing-thrust type. Outside end carries combination faceplate and handwheel. Plain bed or handfeed carriage. Swings 12" diameter over bed, or 9 1/2" over carriage. Turns 24" or more between centers. This is a unit type with motor head and control built integral so that they may be mounted on beds of other lathes. Modernize your old lathes. Permits changing from D.C. to A.C.



No. 51—4-Speed Motor Head Lathe

(Basic Patents Cover Unit Type Motor and Control)

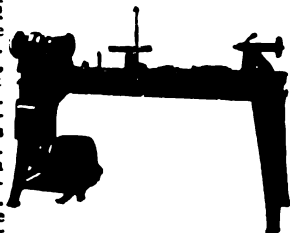


Operates on two- or three-phase alternating current. Four speeds only are available—570, 1140, 1725 and 3425 R.P.M. at full load. Totally enclosed. Thrust ball bearings. Built-in enclosed drum type controller. Other specifications, capacity, etc., same as No. 51K above described.

This unit type of motor headstock with its self-contained controller is easily fitted to old lathe beds for changing them from D.C. to A.C. or making a motor head lathe out of other types.

No. 56 12-Inch Motor-Driven Speed Lathe

Swings 12" over bed, 9 1/2" over carriage and turns 24" to 48" or more between centers. Double ended headstock houses deep groove ball bearings. One piece, four step cone pulley is keyed to hollow spindle. Patented combination handwheel and rear end faceplate. Hand feeding carriage with tool post supplied if desired. Hand tool rests, centers, screw chuck, faceplate, are regular equipment on all "Oliver" Speed Lathes. Bed graduated into 16ths when carriage is supplied. Hand tool rest has machined edge for accurate work. Motor mounted on bracket between head legs is entirely covered; adjustable for alignment and belt tension. Swivel Set-over Tailstock for use with hand feeding carriage, for taper turning, extra on any "Oliver" lathe. Priced considerably below the motor head types.



No. 287 Single Spindle Shaper

High speed (7200 R.P.M.) enables cutting with, against, or across grain without reversing—a 50% saving in knife and cutter head equipment. Oil lubricated, ball bearing spindles. Shaft takes different sized spindles and chucks. 36"x36" ground table. Well guarded. Motor Belted type in self contained manner for ordinary currents. Motor Arbor types for high frequency. Double Spindle Shapers also.



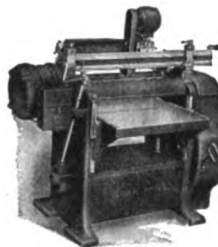
No. 61 Single Surfer

Built-in Motor-on-Arbor. Capable of wide range of work. Takes up to 8" stock and planes 30" or 24" wide. Circular safety cylinder carries four high speed thin knives; ball bearings with Alemite lubrication. Throat between front and rear pressure bars only 2 3/4" to prevent end clipping on very short stock. Four strong, positive rates of feed through sectional or solid in-feed rolls and solid out-feed rolls. Heavy rigid table has a center plate, adjustable for wear and removable. Sectional chip breaker. All gears accurately machined and finished. Knife grinding, jointing and setting attachments as arranged.



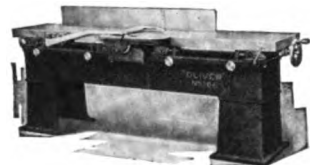
No. 199 24-Inch Single Surface Planer

Takes stock 6" thick, 24" wide, and as short as 10 1/2". One piece bed, 24 1/2"x36", fitted to main frame on four dovetailed gibs; supported by two large diameter screws turning on thrust ball bearings. Circular safety cylinder with three thin, high speed knives and hardened steel chip breakers turn 3600 R.P.M. on double row ball bearings and does extremely accurate work. Feed rolls only 10" apart. Upper in-feed roll corrugated and sectional. Lower rolls adjustable with bed. Feed 21 and 35 feet per min. by means of roller chain, reduction gears, and belt, entirely enclosed and arranged for quick safety release. Sectional chip breaker. Adjustable tension pressure bar. Knife setting and jointing attachment is standard. Motor. Knife Grinder extra.



No. 166 Hand Planer and Jointer

A heavy duty, ball bearing jointer of machine tool construction. Made in 12", 16", 20", 24", and 30" widths, takes cuts up to 3/4". Removable Rabbeting Attachment instead of groove in receiving table. Fence mounted on rear table is 54" long, 6" wide, bevels any angle down to 45°, and permits full width of table to be used. Circular safety cylinder of forged steel machine ground to perfect balance equipped with three thin, high-speed knives—cutting diameter 5". Tables 42" long draw away from cylinder 18", have removable steel lips at throat. Table adjustable for leveling by means of screw lock wedges.



No. 189—8-Inch Hand Planer and Jointer

Top view, Table 60" long, 9 1/2" wide fitted with steel lips next to three knife cylinder 8 3/4" long. Table lowers 1/2" for rabbeting. Ball bearings, automatic guard. Fence 38" long by 4" wide adjustable entire width, tilts to 45°. Full length knives usable when fence is tilted. Motor is 1 H.P., 3600 R.P.M., shaftless, enclosed type mounted directly on end cutter shaft, wired in conduit to automatic push button control.



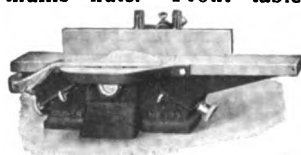
No. 144 6-Inch Hand Planer and Jointer

Bench or column mounting. One piece bed has accurately machined, dovetailed, 60° inclined ways. Cast iron ground tables have steel lips at throat; individually adjustable by means of handwheels; four lock screws. Front table, 6 1/2"x24 1/2"; rear 6 1/2"x24 1/2". Circular safety cylinder with three thin, high speed knives. Ball bearings. Fence 24"x3 1/2" tilts from 90° to 45°, fastened to bracket on rear table out of the way. Rabbeting attachment. "Oliver" Aluminum Automatic Knife Guard regularly furnished for safety.



No. 133 6-Inch Hand Planer and Jointer

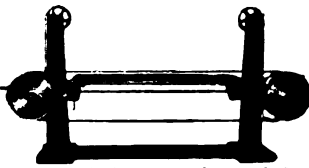
Planes 6" wide, rabbets up to 1/2". One piece frame; inclined ways. Tables adjusted by handwheels and locked by thumb nuts. Front table 6 1/4"x19 1/2" long; rear table 6 1/4"x11 1/4". Adjustable fence. Automatic guard. Three knife circular safety cutter head. Flexible coupling; ball bearing. 1/4 H.P. motor, 3600 R.P.M. Rabbeting Arm and Knife Setting and Jointing Attachments extra. Bench style or mounted on floor stand. Built also in 4-inch size as No. 133-A.



Oliver Machinery Co., Continued

No. 184 Motor-Driven Belt Sander

Ideal for finishing furniture and all other school projects. Entirely self-contained; lined up at the factory. Stands rigidly mounted on base. Cast aluminum and finished ball bearing pulleys, 20" diameter, 7" face, have 32" vertical adjustment on gibbed ways. Pulleys may be raised above or lowered below the table for either flat work or moulding. Idler has 12" horizontal adjustment. Table is 32" wide and 72" long; travels horizontally 36" on ball bearings, takes work 28" high under belt. 2 H.P. motor mounted on the drivepulley shaft has reversing switch.



No. 183-D Motor-Driven Belt Sander

Similar to above except consists of two separate columns mounted on independent floor plates. 96" long; table is independent of columns.



No. 182 Disk Sander—15-Inch

15" diameter aluminum disk, turned true and balanced; slips off disk shaft hub for renewing sandpaper. Speed, 1725 R.P.M. One piece, cast iron housing over disk. Ball bearing end thrust, and exhaust fan. Cast iron table 9 1/4" wide by 21" long has groove to take angle gauge and combination Circle, Segment and Duplicating Gauge. Handwheel and worm and segment tilts table 45° up and 25° down; self-locking and indexed; 6" vertical adjustment. Push button control of ball bearing motor. Six garnet disks and can of "Sando" cement included.

No. 181 Oscillating Spindle Sander

With 1/2 H.P. motor directly connected to spindle which operates in ball bearings. Cast iron tilting table on column. Switch mounted and wired.

"Oliver" Wood Trimmers

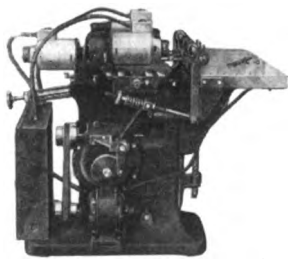
Precision machines. Hand operated. Beds finished smooth and graduated for angle cutting. Principal angles located automatically. All knives adjustable for wear. Capable of great accuracy and production, trimming square, angles, mitres, etc. The No. 9 for bench mounting is illustrated.



No. Machine	Stroke	Depth of Cut	Weight
3 —With column	20 3/4"	7 1/4"	725 lbs.
2 —With column	15"	5 3/4"	460 lbs.
9B—With column	8 1/2"	4 3/4"	250 lbs.
9A—For Bench	8 1/2"	4 3/4"	105 lbs.
0 —For Bench	6"	3"	35 lbs.

No. 71-E Automatic Boring Machine

Motor driven horizontal multiple spindle. Automatic hold down clamps. Power stroke with independent motor and three rates of stroke. Bores multiple holes simultaneously. Distance between bits from 7/8 inch to 15 inches. Distance between outside centers 30 inches or by reversing outside heads 42 inches. Each head has its own motor. Full electric push button control provided. A popular production borer.



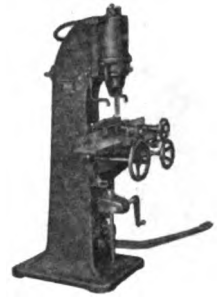
No. 72 Single Spindle Borer

Motor-in-head vertical type, rapid, accurate, sturdy. Will bore holes up to 2-inch diameter any depth up to 6 inches in the center of 36-inch stock with one stroke. Table adjustable 14 inches vertically, swivels in complete circle and tilts to 45° universally. Maximum stroke of spindle 6 1/2 inches. Table 20 inches by 24 inches. Motor 2 H.P., 3600 R.P.M. Blower fan, mounted on spindle. The boring head is fed into the work by footlever.



No. 91 Hollow Chisel Mortiser

2 H.P., 3600 R.P.M. motor built in the mortising head. Ball bearings. Push button magnetic switch, wired in conduit. Direct mounted fan blower. Compound table having wheel rack and pinion feed and clamp. Takes work 12" high and center of pieces 6" wide. Operates with tools 1/4" to 5/8" square in hardwoods and 3/4" in soft woods. Table is 6" wide and 36" long. Length of stroke adjustable and controlled by foot lever; spring counterbalance.



No. 92 Power Feed Hollow Chisel Mortiser

Similar to No. 91 but with separate 1 H.P. self-contained feed-motor driving roller bearing. 3-speed transmission using Tex Rope drive to give 16, 27 or 40 strokes per minute. Electric control provides overload and low voltage protection for each motor.

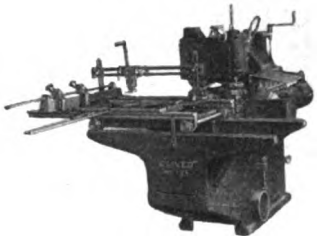
No. 194 Hollow Chisel Mortiser

Bit travels to the work enabling a comparatively small machine to take heavy or large stock. This, with the exceptionally light treadle action, makes No. 194 the ideal school machine where conditions demand a small mortiser. 1/2 H.P. ball bearing motor head, combination hold down and top back fence, and compound table mounted on separate saddles riding on the same vertical ways. Vertical table adjustment of 22" by means of automatic dog and ratchet. Motor slide adjustable for depth of mortise by means of hand wheel. 28" compound table has 13" horizontal travel and tilts to any angle. Takes 22" board on table or 35" board with table removed. Chisel travel 4 1/4". Center of chisel to fence, 4" maximum. Takes 1/2" chisel or 1" boring bit, maximum.



No. 125 Universal Single End Tenoner

Built-in motor-arbor type with 3600 R.P.M. motor built on arbors of both tenon heads, both cope heads and the cut-off saw attachment, making five built-in motors in all and including push button remote unit type control for each motor. The table tilts (or may be made plain); rolls on V-shaped ball bearing ways. All heads carefully guarded; built-in dust chute for connection to exhaust system. Adjustable cam action hold down clamp. Table travels 43 1/2", clamps stock 6" thick, 24" wide; tilts 15°. Capacity for tenons 10" long (by moving work).



No. 585 Variety Oilstone Tool Grinder



Built-in motor on same shaft with emery cone and leather stropping wheels turns 1800 R.P.M. Two oilstone wheels are driven through gears running in oil at 300 R.P.M. All ball bearings. Oilstones automatically saturated. All wheels thoroughly guarded. Tool rest and screw adjusted tool holder. Plug in light socket—push button control. Oilstone wheels, 8" diameter by 2" face. Emery wheel, 8"x1 1/2". Cone, 3" diameter x 5" long.

No. 485 Motor Head Bench Grinder

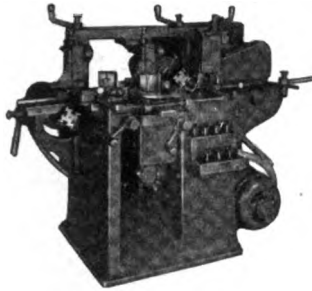
A sturdy, safe, practical, portable bench grinder which will rest firmly without bolting to table. 1/2 H.P. ball bearing motor is fully enclosed and ventilated; turns 1800 R.P.M. One coarse and one fine 8" emery wheel standard; 5"x3" emery cone in addition if desired. Guards completely enclose sides and face of wheels except at front; cone completely covered except when in use. Furnished for power circuit or lamp socket operation.



Oliver Machinery Co., Grand Rapids, Mich.

Oliver Machinery Co., Continued

No. 202 "Oliver" Eaglesfield 4" Electric Moulder



Schools doing semi-commercial or any work in quantity will welcome this first electric moulder to be offered at low price. It consumes little power and occupies but small floor space. It is a commercial producer for mouldings under 4" wide and 2" thick. Chain feed (patented). Fitted with 4 built-in motors for top and bottom and two side heads. Operated best with frequency changer. Built-in feed motor. Variable feed giving any rate desired. Automatic starters for each motor all housed in column. One set heads and knives.

No. 462 Electric Band Saw Brazier



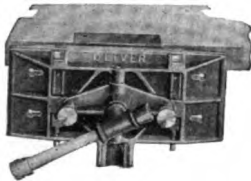
No open flame, no fire hazard, no combustion; no formation of scale on the saw. Utilizes the heat of resistance for melting the soldering metal. Always ready for work and economical of electricity. An inexperienced person can file laps, braze the saw and dress the joint perfectly. Takes blades up to 1½". For A.C. only.

"Oliver" Electric Glue Pots and Heaters

Dry type—no water bath, therefore no burn outs or spoiled glue. Thermostat keeps temperature always between 140 and 145° without waste of electricity because there are no resistances. Thermostat cuts multiple circuits in or out one at a time; not affected by vibration. Heat always evenly distributed. Pot is copper. Heating element is special wire wound about asbestos core and wrapped around inner wall of pot. Sizes from one pint to two gallons. Also Glue Cookers and Babbitt Pots. One quart is usually ordered to operate on lighting circuit.



No. 1 Universal Vise



For patternmaking and wood-working. Swivels and adjusts to any desirable position. Jaws are 7¼" wide 18" long, will open to 16". Clamps angle pieces. Steel faced jaws for clamping metal. Four dogs. Holds circular and irregular pieces.

"Oliver" Woodworker's Vises

Solid nut or quick acting. Strong, efficient, reliable. Few parts. Good vises at a low price. Cast iron jaws 1½" dia. Steel screw. Steel guide bars and bronze nut. Guaranteed.



No.	Description	Jaw	Opening	Shipping Weight
150C	Quick Acting Vise	7" x 4"	12"	55 lbs.
151D	Quick Acting Vise	10" x 4"	12"	65 lbs.
160D	Solid Nut Vise	7" x 4"	12"	55 lbs.
161D	Solid Nut Vise	10" x 4"	12"	65 lbs.
221A	Solid Nut Tail Vise	4" x 4"	6"	45 lbs.

Note—1" steel dog in front jaw on all "Oliver" vises.

Cabinet Maker's and Manual Training Benches



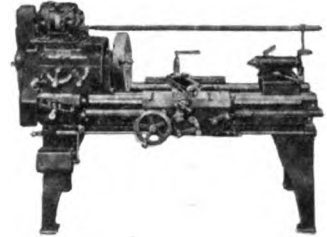
No. 106 Cabinet maker's bench with top 78" long, 25" wide, 34" high. Glued-up maple bed 14" wide, 2½" thick. Legs 2¾" x 3¼", fitted with "Oliver" No. 151-D vise and regular cabinet maker's wooden tail vise.

No. 1250 Manual training bench, top 52" long, 22" wide by 2½" thick, 32" high. Top Michigan hard maple, oiled and varnished. Steel bolts run through glued-up section. No drawers. Metal planing stop. Steel bench dog and No. 160-D vise (other vises optional).

No. 1251. Same as No. 1250 except with one large drawer having master-keyed lock.

No. 1255. This bench is illustrated. Same as No. 1250 except with one large and four small drawers all fitted with master-keyed locks.

"Oliver" Engine Lathes



15"x 6' bed lathe is illustrated. Quick change gears. Actual swing 15¼" over bed; 9½" over carriage; 37½" long between centers. Geared head, motor driven through silent chain. Chain guard. Drum type safety reversing switch. Power longitudinal and cross feed. Double plate apron having steel gears; compound rest, tool post, large and small faceplates, center rest; thread chasing dial; two conical centers.

"Oliver" Engine Lathes are offered in 11", 13", 15", 16", 18" and 26" sizes. Write for full descriptive circulars of any "Oliver" machines in which you may be interested.

Motor Head Grinders for the Machine Shop



No. 484-A motor head bench grinder. ½ H.P., 2400 R.P.M. D.C. or 1800 R.P.M. A.C. Completely enclosed motor with self-contained starter; fitted with two 8"x ¾" emery wheels with steel guards or hoods, one straight tool rest, one right angle tool rest and one water pot.

No. 484-B motor head bench grinder consists of a 1½ H.P., 1800 R.P.M. Completely enclosed motor with self-contained starter; two 12"x 1" grinding wheels with steel hood guards, one straight tool rest, one right angle tool rest and one water pot.

No. 484-C motor head column grinder (illustrated). Consists of a 2 H.P., 1800 R.P.M. enclosed motor and starter, all fitted with two 12"x 2" grinding wheels with steel guards or hoods, one straight tool rest, one right angle tool rest and one water pot. Shipping weight, 700 lbs.

"Oliver" Forges

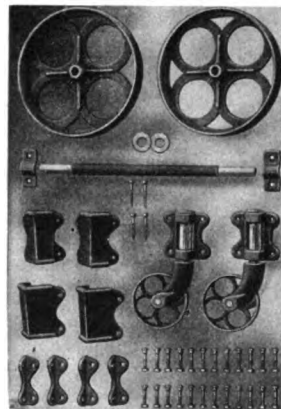
The engineering features connected with the "layout" for forge equipment should be entrusted only to experts. "Oliver" engineers are prepared to serve you in making "layouts" and writing specifications covering the arrangement of underground conduits for air pressure and carrying away the gases, selection of blower and exhaust fans, etc.

"Oliver" Forges are of cast iron type. Write for detailed specifications.



No.	Description	Crated Weight
130	Single Down Draft Forge	700 lbs.
130	Double Down Draft Forge	1170 lbs.
131	Instructor's Up Draft Forge	500 lbs.

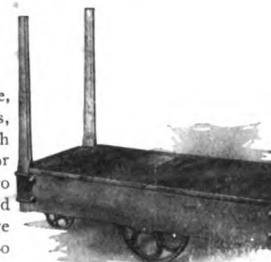
No. 180 Factory Truck and Metal Parts



Factory trucks are useful in every shop. Build them in your shop with special design if you wish to meet your particular conditions. An excellent project. Factory truck metal parts at foundry prices. Use our standard drawings. Use your lumber. Blue print with estimate of lumber required for assembly furnished with every order.

Description

No. 180 metal parts, consisting of one axle, two 14-inch big wheels, two 1-inch washers, two axle caps, four lag screws, two 6-inch castor wheels, two castor shafts, two castor forks, two ¾" washers, two brackets, two right hand stake pockets, two left hand stake pockets, four corner irons, 24 carriage belts. Wood parts and complete trucks also offered.



Oliver Machinery Co., Grand Rapids, Mich.

Yates-American Machine Co.

Vocational Division

Rochester, N. Y. Beloit, Wis. Hamilton, Ont.

Branches: Boston, Mass.; Chicago, Ill.; Detroit, Michigan; Cleveland, Ohio; Memphis, Tenn.; New York, N. Y.; Portland, Oregon; Rochester, N. Y.; San Francisco, Cal.; Los Angeles, Cal.

Manufacturers of

Woodworking Machinery

No. 20 Universal Saw Bench

For Junior High and Senior High Schools

Made for accurate sawing of all kinds of light and medium work and used in more school woodworking shops than any other machine of its type. Provided with two ball bearing arbors, one for ripping and one for cross-cutting. Either arbor quickly swung into position. Table, 38"x36", tilts 45 degrees; movable section 15" wide, rolls on ball bearings. One universal ripping gauge, one cut-off gauge and two mitre cut-off gauges. Two 14" saws (one rip and one cross-cut); projects 3¼" above table. A special sleeve is



furnished for dado heads up to 2" wide. Requires 5 H.P., arbor speeds 3000 R.P.M. with 1200-1800 R.P.M. motor. Can be had with either countershaft or motor drive.

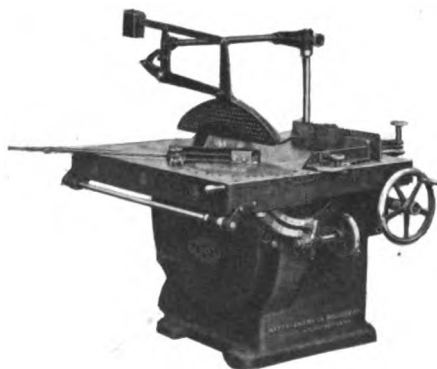
This machine is highly recommended for both Junior and Senior Schools and will handle a wide range of work.

No. 30 Universal Saw Bench

For Trade and Technical Schools

The foremost machine of its type and almost indispensable in the Trade or Technical School. A high grade precision tool that will rip, cut-off, miter and dado with extreme accuracy. All adjustments easily and quickly made.

Two ball bearing arbors take 18" saws which will project 5¾". Entire table tilts; measures 40"x48" and has movable



section 17" wide; graduated sector on movable section is divided in degrees and inches. Four gauges; universal ripping gauge; two mitre cut-off gauges, and one plain cut-off gauge. Rips from 1½" to 26"; will cut-off to 31" wide; thickness 5¾" with 18" saws; dado head will take cut 2½" wide. Available for either countershaft or motor drive. 5 to 7½ H.P. required.



No. 1 Variety Saw Bench

For Junior High and Senior High Schools

This machine will cover a great range of work encountered in Junior and Senior classes. Table adjusts 4" vertically and tilts to 45 degrees. Will rip up to 20" wide and cut-off to 26" wide and 2¾" thick with 12" saw. Regular equipment includes: plain table 36"x44"; removable throat plate; ball bearing arbor; countershaft drive or direct motor drive. The machine can also be equipped to do dadoing, jointing, boring and mortising and can be had with sliding table at left of saw. Can also be furnished with

motor mounted on base of machine and belted to arbor.

Weight 1130 to 1210 lbs.

The flexibility and versatility of the No. 1 Variety Saw Bench with its special equipment make it ideal equipment for the school desiring a high quality precision machine capable of doing a multitude of jobs.



No. 0 Saw Bench

For Senior High, Trade and Technical Schools

The No. 0 Saw Bench is built especially for use in the school shop and because of its adaptability to a wide range of work, its durable and rigid construction and moderate cost is very popular. It is a direct motor driven unit with ball bearings for the arbor. The tilting table is 27"x30" and has removable throat plate. There are three gauges regularly furnished; two swivel cut-off fences adjustable from square to 45 degrees and one double face rip gauge. One 12" saw furnished. The machine rips up to 13" wide and cuts off to 12" wide and 2¼" thick on motor driven machine. Direct motor driven model is equipped with 2 H.P. 3600 R.P.M. motor. Belt drive can also be furnished. Machine weighs 850 lbs.



Yates-American Machine Co., Beloit, Wis.

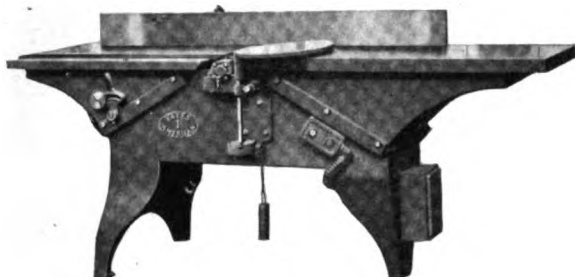
Yates-American Machine Co., Continued

No. 1 Hand Jointer

For Junior High, Senior High and Trade Schools

The No. 1 Hand Jointer, made in sizes from 8" to 36", is universally known and used. The smaller sizes (8", 12", 16" and 20") are standard school equipment.

Combined length of tables is 7'. Rear table adjustable for hollow joints. Both tables can be drawn away from head on a level independent of inclined ways. Four-knife round



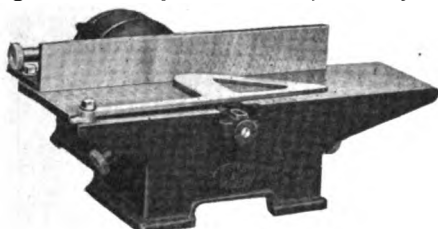
safety head, motor driven machine and three-knife belt driven model; ball bearings. Safety guard and rabbeting bracket are regularly furnished. Regularly furnished belt or direct motor driven but can also be had with motor mounted on special base attached to machine and belted to arbor. On direct motor driven 8", 12" and 16" machines, 3 H.P., 20" and 24" machines, 5 H.P.

Type B-11 Bench Hand Jointer

For Junior High, Trade and Technical Schools

An invaluable tool for handling all small work. Available in 4", 6" and 8" sizes. 4" machine babbitt bearing, 6" and 8" machine ball bearing.

Three-knife round safety head and safety guard are standard. Long inclined ways. Table adjusted by handwheels

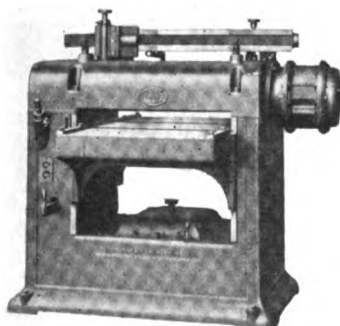


and clamped to bed by hand levers. Rabbeting groove in short table. May be had with countershaft drive but direct motor drive is highly recommended. This machine may be equipped with base for floor mounting.

B-8 Surfacer

For Senior High, Trade and Technical Schools

The B-8 Single Surfacer is without a peer in the smaller surfacer class. It is built in two sizes, 24"x8" and 30"x8" and the smaller size is particularly adapted to school use. Among those features making it most popular for school



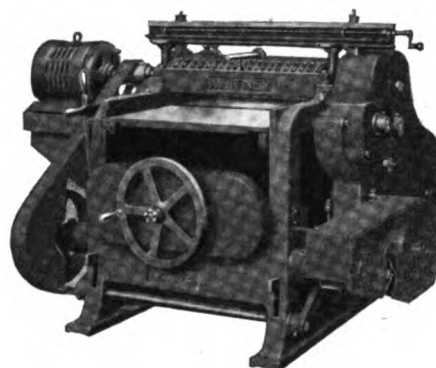
use are: complete safety in operation, every moving part being enclosed; simplicity and ease of operation and its

capacity to do the highest quality of cabinet surfacing. There are two rates of feed, 20 and 40 feet per minute. The feed works has gear box, all the gears of which run in a bath of oil. The head is of the four-knife round type running in ball bearings. Chipbreaker swings concentric with head so no matter how deep the cut can not strike knives. Either belt or direct motor drive is regularly furnished. The 24" direct motor driven model is equipped with 10 H.P. A.C. 3600 R.P.M. motor; the 30" machine with 15 H.P. motor. 24" machine weighs 3,000 lbs.; 30", 3,300 lbs.

No. 32 Whitney Single Planer

For Trade and Technical Schools

No. 32, an accurately built machine capable of doing the smoothest cabinet surfacing, finds wide application in Trade and Technical Schools when a sturdy, high quality machine is desirable. Belt drive is regularly furnished but motor drive with direct coupled motor can be had. Four plain

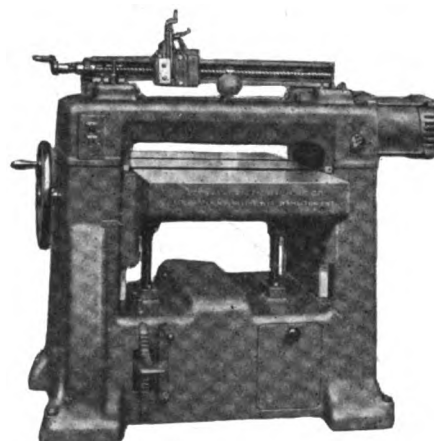


rolls all driven and flexible chipbreaker. Sectional rolls and chipbreaker on special order. Knife setting and truing attachment and motor driven grinder are regular equipment. Takes stock from $\frac{1}{8}$ " to $7\frac{3}{4}$ " thick and pieces as short as $13\frac{1}{2}$ " or 3" when butted. Round four-knife head, ball bearing, is standard. Two sizes, 24" and 30" widths.

New B-4 Single Surfacer

For Trade and Technical Schools

One of the very few commercially acceptable machines really designed especially for the school shop. The B-4 Single Surfacer is a small, heavily built precision machine capable of handling the full range of school work. The ball bearing, 3-knife round safety head is fully protected by the top girt.

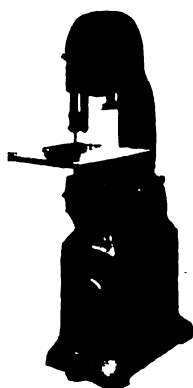


This, together with convenient push button control, simple adjustments and handy foot lever for changing feeds makes the B-4 not only safe but extremely easy to operate. Point-by-point, the B-4 is the finest Single Surfacer ever made available for use in either Junior or Senior Schools.

Yates-American Machine Co., Continued

Y-16 Band Saw

For Trade and Technical Schools



The Y-16 is a new Yates-American Band Saw developed designed particularly for school shop use, and because of its portable feature which allows it to be readily moved from place to place, has a strong appeal to many instructors. It will handle practically all of the smaller types of work in the same efficient manner as the larger Yates-American band saws. It takes 15" between saw and frame and 8" maximum thickness under guide with saw guard on. The 16" diameter wheels run in ball bearings. Both wheels and saw blade are completely guarded. One $\frac{3}{8}$ " blade furnished. Will handle blades $\frac{1}{8}$ " to $\frac{3}{4}$ " wide. Top and bottom roller guides supplied with machine. Tilting table is 20"x 22".

Machine regularly equipped with $\frac{1}{2}$ H.P. 900 R.P.M. motor with control. An allowance is made if portable base is not wanted.

Y-30 and Y-36 Band Scroll Saws

For Trade and Technical Schools

These band saws are adaptable for use in all types of manual training and vocational schools. The Y-30 (30" wheels) is the light duty and the Y-36 (36" wheels) the heavy duty machine. One of the most popular features of these machines is their great strength and rigidity, assuring freedom from vibration and greatest durability. The same patented straining device and anti-friction guides that are employed in the larger Yates-American band rip and resaws assures smooth operation. Main table of Y-30 28"x 30", auxiliary 15"x 13"; Y-36 36"x 36", auxiliary 13"x 18". Throat measurement of Y-30, 29 $\frac{1}{2}$ " from saw frame to saw, Y-36, 35 $\frac{1}{2}$ ". Widest stock that can be taken under guide with guard on, Y-30, 16"; Y-36, 19". Both machines can be supplied belt or direct motor drive and can also be furnished with motor mounted on bracket on rear of machine and belted to arbor. The direct motor driven Y-30 is equipped with 3 H.P. 900 R.P.M.—A.C. motor; the Y-36 with 5 H.P. 900 R.P.M.—A.C. motor. These band saws will meet the most rigid requirements of any type school.



Y-3 Self-Contained Jig Saw

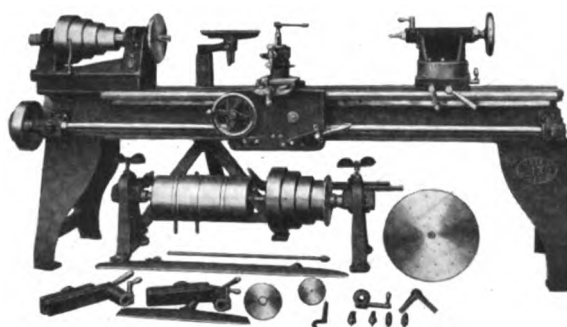
For Trade and Technical Schools



It is far more rigid than the usual machine of this kind due to the heavy, one-piece cast frame and massive construction throughout. The drive unit is completely enclosed in the frame. There is a foot brake; a simple and effective straining device; an efficient blower system; adjustable table and other features. Blade straining device has no levers, links, pivots or other parts which commonly cause trouble. Takes work 36" wide between saw and frame and 10" under guide. Tilting table. Drive is through disc type friction clutch operated by foot treadle. Interior and exterior irregular sawing is best done on the Jig Saw and the Y-3 is ideal for such work.

No. 13 Pattern Makers Lathe

For Trade and Technical Schools

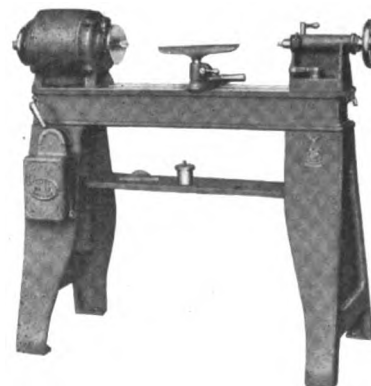


This machine is available in several types of drives but the Motor Head Type has certain advantages such as greater simplicity, reliability and safety. No. 13 is of high quality throughout and includes all refinements necessary to provide a complete machine capable of doing accurate and intricate work. The Lathe is regularly furnished with hand feed carriage but power feed can be supplied. Three sizes: 16", 20", 24" swing over bed, 62" between centers (standard with motor head). Hollow steel spindle runs in bronze bearings. Tail block has set-over and swiveling features and is graduated. Standard equipment includes floor stand, centers, faceplates, chuck, rests, etc. This is ideal equipment for advanced work or for instructors' use. The shop employing smaller speed lathes should have at least one No. 13 for demonstration work or to handle occasional jobs beyond the scope of the ordinary machine.

No. 12 Speed Lathe

For Junior and Senior High Schools

This lathe has been adopted as standard by many schools because they have found it to be the simplest, easiest, safest lathe to operate. Both starting of the motor and speed control is combined in one operating handle. A scale denoting the four speeds is provided and it is simply necessary to bring the handle to the proper speed as indicated on the scale. Nothing could be more convenient or trouble proof



nor as safe. The operator can not start the motor at too high a speed. The four speed A.C. motor is much simpler in construction than a variable speed type and eliminates all the disadvantages inherent in the latter.

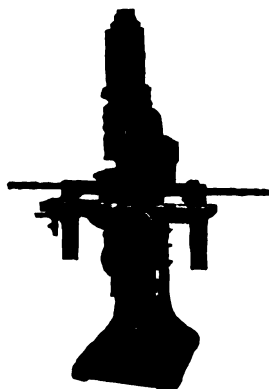
The No. 12 lathe has 12" swing over the bed and may be had with 48" (standard), 55", 60", 72", 90" or 96" bed. It is regularly equipped with tool rest, faceplate and centers. Extra equipment includes outside faceplate, set-over tail block, floor stand, back rest, carriage and compound rest tool post and universal tool holder, etc.

Yates-American Machine Co., Continued

Type K-25 Hollow Chisel Mortiser

For Senior High, Trade and Technical Schools

The K-25 is a distinctly superior mortiser with all the latest modern improvements and many exclusive features incorporated in its design. It is direct motor driven, the vertical motor being mounted directly on the spindle. The spindle is a splined shaft which slides up and down within the motor rotor, allowing a stationary mounting for the motor. It will mortise $\frac{5}{8}$ " deep with 12" clearance under chisel and will mortise in center of material $5\frac{1}{2}$ " wide. Chisel ram operates by foot power. The ball bearing spindle rotates at 3600 R.P.M. The plain table tilts 30 degrees right or left and is adjustable to and from column; provided with detachable plate for "through" mortising. Clamp type table furnished at extra price. Three chisels, one $\frac{3}{8}$ ", $\frac{1}{2}$ ", and $\frac{5}{8}$ " with 5" blades and with bits to correspond. Machine is equipped with 2 H.P. 3600 A.C. built-in motor with full electric protection. Machine occupies floor space of 3' 6" x 2' 6" and weighs 1390 lbs. The K-25 is an invaluable school woodworking tool that will give the longest and hardest service.



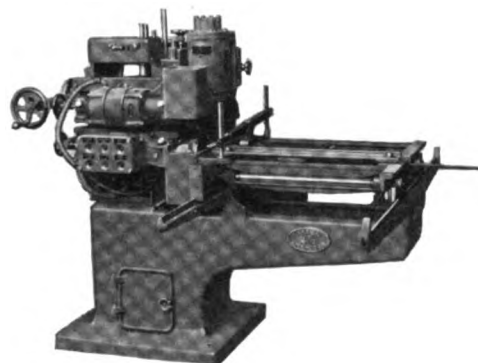
Type N-4 Reversible Shaper

For Junior High, Senior High, Trade and Technical Schools

This shaper is made with a reversible countershaft for belt drive and has ball bearings for the spindle. The machine is here shown with vertical motor mounted on special base and belted to spindle but various other drives can be furnished. The table is 32" x 36" and has movable center plate 6" in diameter surrounding the spindle. One detachable upper spindle section, one table ring, two steel collars and one pair of plain shaper knives and two fill-up collars are regularly furnished. Weight 1650 lbs.



The No. 2 1/2 Tenoner

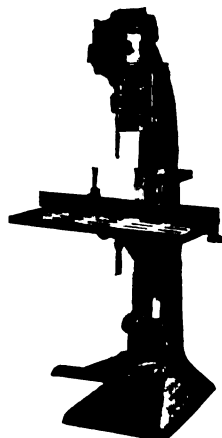


For Senior High, Trade and Technical Schools

Designed for fairly heavy work and regularly equipped with one set of round or wing type tenon heads as specified and no copes or saw. One or two copes and front and rear cut-off saws can be supplied, however, as well as various motor drives. It will easily handle all work within the scope of school projects. Cuts tenon $3\frac{7}{8}$ " long or $7\frac{3}{4}$ " long in two operations. Any thickness of tenon can be cut on stock up to $5\frac{1}{2}$ " thick and 15" wide. Carriage has combination roller movement, patented bridge bar and end stop gauge. Direct motor drive has 1 H.P. motors for each tenon head arbor and weighs 1980 lbs. without motor.

Type U-21 Boring Machine

For Senior High, Trade and Technical Schools

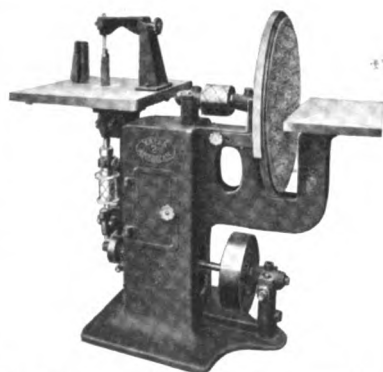


The U-21 is the ideal boring machine for school use. It excels your every conception of boring machine efficiency. It was made for light duty work, but its design and construction is so rigid that it will handle much heavier work than is usually expected of a machine of this type. The table is 20" x 30" and has a vertical up and down adjustment of 16". It can be tilted to the right or left 45 degrees or vertical for edge boring. It can also be adjusted in or out $1\frac{1}{2}$ ". The U-21 is direct motor driven with a 1 H.P. 3600 R.P.M.—A.C. motor with push button control. The floor space required is small, being only 2' 9" x 3' 4". When ready for operation the U-21 weighs 800 pounds.

Type S-10 Disc and Spindle Sander

For Senior High, Trade and Technical Schools

This sanding tool will handle a large variety of work expeditiously and well. It is almost indispensable in the school shop. The disc is made of aluminum. Its diameter is $26\frac{1}{2}$ " with a working diameter of 24". The frame is cast in one piece, making the machine very rigid and substantial. The spindle can be used with or without the overhead steady bearing. The No. 2 can also be furnished as a disc and drum sander.



Head and Knife Department

The Yates-American line of head and knife equipment is the most complete ever offered. Regardless of the type of machine, we can supply you with knives or a complete head. All heads and knives are made in our own factory with the best of modern machinery and under close laboratory supervision. The Triple S Knife for jointers, planers, surfacers, shapers and other machines is very highly regarded by industry, for it has established an enviable reputation for toughness and durability.

Additional Information

We will gladly furnish detailed information on any type of woodworking equipment and will be glad to supply bulletins covering specific machines in which you may be interested. Address communications to the company at Beloit, Wisconsin.

Yates-American Machine Co., Beloit, Wis.

J. D. Wallace & Co.

161 So. California Ave., Chicago, Ill.

Branches in principal cities
Manufacturers of

Portable Woodworking Machinery

Wallace Portable Machines will handle all of the woodworking in any school efficiently, safely and economically. While they are truly portable, this Wallace feature is not obtained through a sacrifice of strength for lightness. Each machine is rugged and rigid, and is powered by a motor of sufficient capacity to easily take any cut within the rating of the machine.

Wallace Portable Machines will do accurate work. They are designed and constructed with such care and precision that even the smallest, most exacting work can be done with convenience, safety and absolute accuracy. Individual motors are built into Wallace Portable Machines. This method of obtaining a direct drive, thereby eliminating all waste of power through belt slippage and the useless driving of countershafts and pulleys, is in line with the Wallace policy to build the most modern and efficient machinery.

Nos. 8 and 20 Wallace Universal Saw

This is a powerful portable floor type of Universal Circular Saw combining the advantages of the portable bench machine and the self-contained floor type. Its equipment is complete and includes motor, switch, 10-ft. cable, saw guard, rip and cross-cut fences, and saw blade.

One-half or one h.p. air cooled G. E. motor direct connected. Splash lubrication of gears. Tilting saw arbor adjustable to 45 deg. and depth of cut. Two cross-cut fences adjustable to 90 deg. traveling on rails beneath the steel table top. Rip fence also travels on rail beneath table, eliminating all grooves in the table top. Graduations show exact angle to which saw is tilted or cross-cut fences are set. Removable throat permits use of dado and cope heads. Safety guards both above and below table; special hood guard is extra. Furnished either from light or power circuit.

Specifications

	No. 8	No. 20
Depth of cut, maximum.....	2 1/4"	2 1/4"
Diameter of saw blade.....	8"	8"
Diameter of saw spindle.....	3/4"	3/4"
Speed of saw blade.....	5200 r.p.m.	5000 r.p.m.
Speed of motor.....	1800 r.p.m.	7500 r.p.m.
Size of motor—D. C. or single phase A. C.....	1/2 h.p.	1/2 h.p.
Size of Special Motor.....	1 h.p.	1 h.p.
Height of machine, including stand.....	35"	35"
Size of table.....	25x25"	20"x20"
Weight of saw, including motor and stand—net..	275 lbs.	185 lbs.

No. 16 Portable Band Saw

The Wallace No. 16 Portable Band Saw handles all work with accuracy and convenience and without wasted power. Because of its many safety features it is an ideal school machine.

Direct motor drive from ball bearing G. E. motor of either 1/2 or 1 h.p. Gears, armature and wheels are dynamically balanced. Splash and oil cup lubrication. Steel table top tilts from minus 5 deg. to plus 45 deg.; large bearing block



Safety is of paramount importance in the selection of school equipment. The Wallace method of individual direct motor drive is also a safety feature. It does away with the hazard of open belts and belt breakage. The compact small size of Wallace

Portable Machines allows either man or boy to work while standing comfortably in a natural position without leaning over or upon oversized tables or frames. This feature adds not only to the safety and confidence with which the machine may be operated, but adds immensely to the convenience as well.

In spite of the high standards to which Wallace Portable Machines are built and up to which they must perform, their first cost is small: Maintenance almost negligible. This low cost permits a school to install two or three Wallace Machines for little more than a single large machine of similar high grade design and construction would cost.

and machined ways. Ball-bearing guides above and below table. Safety guards completely enclose blade except at working point—smooth disc wheels. Furnished to operate either from light or power circuit.

Specifications

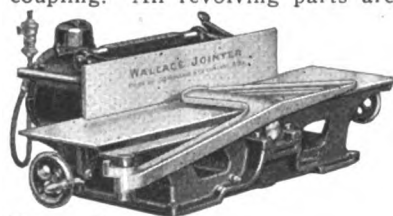
Diameter of Wheels..	16"
Maximum space under guide.....	8"
Length of Saw Blade	9'
Speed of Band Wheels	750 r.p.m.
Blade travels at.....	3150' per min.
Speed of Motor.....	1800 r.p.m.
Size of Motor, single phase or D.C.....	
rent	1/2 h.p.
Size of Special Motor.	1 h.p.
Height of Table from floor	42"
Height of Machine, overall	5'9"
Size of Table.....	19x21"
Weight of Band Saw, with motor, net...	340 lbs.

Six- and Eight-Inch Portable Jointers

Like all Wallace machines these Jointers have ample power to handle the heaviest cutting up to their rated capacities, efficiently. They are designed and balanced the most exacting operations with precision. The patented Wallace Guards with which these machines are equipped render them the safest jointers available. Direct motor driven, through flexible coupling. All revolving parts are dynamically balanced.

Ball or roller bearings used. Tables are accurately ground to .001 in. limits. Table remains as set without locking. Fence mounted on two rods, quickly and easily adjusted.

Fence tilts to 45°. Furnished for operation from either light or power circuit.



Specifications

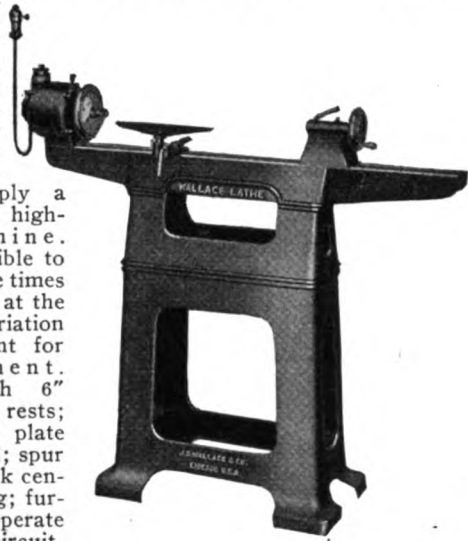
	Six-Inch	Eight-Inch
Length of Knives.....	6"	8"
Depth of cut, maximum.....	1 1/4"	3/4"
Length of each table.....	15"	20"
Length of machine, overall.....	30"	40"
Speed of cutterhead.....	3600 r.p.m.	3600 r.p.m.
Speed of Motor.....	3600 r.p.m.	3600 r.p.m.
Size of Motor for single phase and D. C.....	1/2 h.p.	1/2 h.p.
Size of Motor for single or 3 phase A. C.....	1 h.p.	1 h.p.
Number of knives.....	3	4
Weight of Jointer, including motor.....	150 lbs.	200 lbs.
Wallace cast iron Work Table for either 6" or 8" Jointer	Extra	Extra

J. D. Wallace & Company, 161 So. California Ave., Chicago, Ill.

J. D. Wallace & Company, Continued

No. 66 Portable Lathe

At last a precision built lathe is obtainable for the schools at a very nominal price—a 6" Lathe, 36" between centers, capable of handling every operation done in the schools. Single speed—a speed that is correct for handling all work within the capacity of the machine; unnecessary frills eliminated in order to supply a popular priced, high-quality machine. Now it is possible to get two or three times as many lathes at the same appropriation heretofore spent for such equipment. Equipped with 6" and 12" tool rests; combined face plate and hand wheel; spur and screw chuck center, ball bearing; furnished to operate from lighting circuit.



Specifications

Maximum capacity over Tool Rest.....	5"
Maximum capacity on Face Plate.....	7"
Distance between centers.....	36"
Speed of Motor, D.C. or A.C., 60 cycle.....	1800 r.p.m.
Special, high speed motor for D.C. or A.C., 60 cycle.....	3400 r.p.m.
Size of Motor for single phase or direct current.....	1/2 h.p.
Size of Motor for three-phase current.....	1/2 h.p.
Height of Lathe overall.....	47"
Height of Arbor from floor.....	42"
Length overall.....	49"
Weight of Lathe complete, net.....	203 lbs.

Solem Thickness Planer

The Solem Ball Bearing Planer is a portable machine designed to meet exacting requirements of fine surface planing on all kinds of small wood parts used in the school woodworking shops. This planer finds its place in industrial training school shops because it can be quickly set for odds and ends of stock requiring surfacing to an exact thickness and because it does not require a large investment.

Some of its finer features are: Short stock can be salvaged. Blocks as short as two inches can be dressed and pieces six inches long will pass through without following. Obviously material any length can be planed. The capacity of the Solem is 12" wide by 3" thick with a feed rate of ten feet per minute and a 1/8" cut. Three knife safety type Cutter Head is mounted on Ball Bearings and readily removed from machine. Chip Breaker is concentric with the Cutter Head as is the Pressure Bar. And both motors are built into the machine and can be connected to either light or power socket.



Specifications

Length of knives.....	12"
Number of knives.....	3
Cutting circle, diam.....	2 1/4"
Depth of cut (max.).....	1/8"
Width of cut (max.).....	12"
Thickness of stock (max.).....	3"
Rate of feed per min. (max.).....	10'
Upper feed rollers, diam.....	2"
Lower feed rollers, diam.....	3"
Motor on head, A.C. or D.C.....	1 h.p.
Motor on feed rolls, A.C. or D.C.....	1/2 h.p.
Floor space.....	44" x 22"
Weight of planer, without base.....	400 lbs.

No. 9 Portable Hollow Chisel Mortiser

The No. 9 Wallace Mortiser includes every essential feature. Simplicity has been secured and efficiency increased by omitting attachments and adjustments not called for in ordinary work. Large steel rods accurately ground replace the ordinary dovetail ways. Direct motor drive by 1/2 or 1 h.p. G. E. ball-bearing motor eliminates gears and belts.

Air blast which cools motor also cools chisel and disposes of chips. Perfect table quickly adjusted up and down or forward and back. Foot stirrup control is most convenient for picking up as well as pushing down. Furnished for either lighting or power circuit.

Specifications

Length of table.....	24"
Vertical adjustment of table.....	10"
End of chisel to table, maximum.....	12"
Vertical travel of chisel, maximum.....	4"
Center of chisel to table fence, maximum.....	3"
Chisel size, maximum.....	1 1/2"
Speed of boring bit, r.p.m.....	3450
Size of standard motor, single phase or D.C.....	1/2 h.p.
Size of special motor.....	1 h.p.
Chuck capacity, maximum diameter.....	1 1/2"
Height of machine.....	69"
Floor space, diameter.....	24"
Weight of machine, net.....	325 lbs.

Wonder Spindle Oscillating Grinder and Sander

Made in two sizes—9-in. spindle and 11-in. spindle. Accurately ground table tilts 45 deg. either way from horizontal, mounted on two large ground rocker bearings. Three removable spindles—1 1/2, 2 3/4, and 4 1/2 in. diameter. The two larger spindles are split for convenient changing of garnet or sandpaper. Oscillation may be started or stopped by means of a convenient hand lever without stopping the spindle. One-half h.p. G. E. ball-bearing motor directly connected to spindle. Thrust is taken by ball bearings. May be had for either light socket or power circuit operation.

Specifications

Spindle Sander	No. 9	No. 11
Length of Spindle.....	9"	11"
Size of Table.....	21 1/2" dia.	21" square
Height of Table from Floor.....	37"	37"
Diameter of Spindle Shaft.....	1"	1 1/4"
Speed of Motor.....	1725 r.p.m.	1725 r.p.m.
Size of Motor.....	1/2 h.p.	1/2 h.p.
Weight.....	260 lbs.	310 lbs.

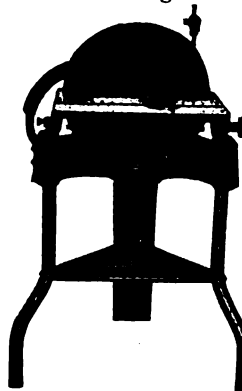


Wonder Disc Grinder and Sander

Small sanders do far more accurate work and are much safer than large machines. The Wonder Portable Disc Grinder and Sander is made in two sizes—12-in. and 16-in. disc. The ball bearing G. E. motor of 1/2 h.p. carries the disc directly on its shaft. Table mounted on two large ground rocker bearings is accurately ground and is adjustable 45 deg. either way from horizontal. Dust collecting system catches practically all dust and deposits it on the floor through the hollow rear leg. Machine stands solidly anywhere on its three legs. Armature and discs run smoothly because they are dynamically balanced. Either lighting or power circuit operation may be had.

Specifications

	No. 12	No. 16
Disc Sander	Disc Sander	Disc Sander
Diameter of Disc.....	12"	16"
Size of Table.....	7 1/2 x 14 1/2"	9 x 20"
Height of Table from Floor.....	37"	37"
Speed of Motor.....	1725 r.p.m.	1725 r.p.m.
Size of Motor.....	1/2 h.p.	1/2 h.p.
Weight.....	150 lbs.	250 lbs.



Workace Electric Shaper

Direct motor driven, high speed, and portable, fast, accurate, economical. Can be placed along side of the work thus saving wasted steps and increasing production. Ample power and capacity, ideal for the shop. In large plants the Workace Electric Shaper will take a volume of work off the big machines at lower labor, operating, maintenance and investment costs. capacity—Between shaper collars 2 1/2"; using solid cutters 3 3/4".



J. D. Wallace & Company, Continued

Automatic Electric Glue Pot

Absolutely automatic and fool-proof in its operation. By maintaining an even temperature between 140 and 150 deg. Fahrenheit, it insures against the failure of glued joints. Although the Wallace is a "wet" glue pot, it is nevertheless quick heating because of the large radiating surface formed by built-in flanges and because of the fact that it dissipates 650 watts while heating. Water is sealed in to prevent slopping and evaporation. The famous Westinghouse "click" control is positive and sensitive in its action and eliminates the necessity of having instructor or student watch the temperature—a saving of time, glue and electric current. Made entirely of aluminum and monel metal, preventing rust and spoilage of glue. Ten-foot cord has separable plug at each end. Approved by the Underwriters' Laboratories for safety and fire risk.



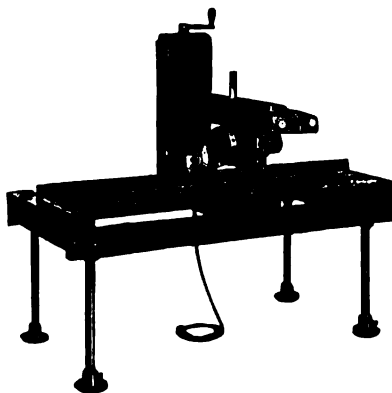
Specifications

Glue Capacity.....2 qts.
Heating Element.....650 watts
Net weight.....11 lbs.

Workace Radial Saw

The Workace Electric Radial Saw is quickly adjustable for angle cutting, compound mitering, cut off, ripping, dadoing, tenoning, routing, shaping, fluting, boring, or sanding.

When using the 8" blade the saw will cut $2\frac{1}{2}$ " stock; with a 9" blade, 3" stock; and with dado or moulding heads, 1" wide. Saw has crosscut travel of $19\frac{1}{2}$ ", and will handle stock of G. E. Universal motor for 110 Volts D.C. or A.C. of 25-60 cycle. 220 volt motor supplied if desired. Saw blade driven through steel spur gears, 2:1 reduction, and mounted directly at end of motor housing. Motor Drive Unit mounted on turn table discs which slide on two $\frac{7}{8}$ " steel rods located in the Radial Arm.



Turn table may be locked at any position or angle. Radial Arm is mounted on a vertical turn table 10" in diameter on the upright column and may be locked at any position. Radial arm slides up or down on two vertical steel bars and weight is regulated by crank and screw. Saw may be purchased with or without cast iron table and legs. Regular equipment includes 10' cable and plug, Safety Saw Guard, one 8" saw blade for cross-cutting and ripping, and wrench for lock nut.

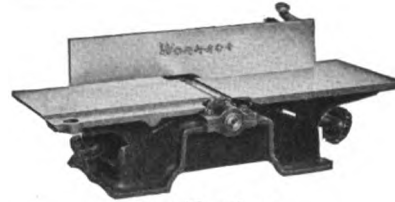
Specifications

Depth of cut, with 8" blade, $2\frac{1}{4}$ "; with 9" blade.....3"
Distance of horizontal travel of saw..... $19\frac{1}{2}$ "
Rise of radial arm on vertical column..... $5\frac{1}{4}$ "
Diameter of saw blade furnished.....8"
Diameter of saw mandrel..... $\frac{1}{2}$ "
Speed of saw blade, under average load.....4000 R.P.M.
Speed of motor, under average load.....8000 R.P.M.
Size of motor..... $\frac{1}{4}$ H.P.
Height of machine including stand.....54"
Height of cast iron table top including stand..... $32\frac{1}{4}$ "
Size of cast iron table top..... $19\frac{1}{4}$ " x 17"
Diameter of turntable plates; on motor 6"; on radial arm 10"; on vertical column.....10"
Weight of saw without cast iron table or legs (net).....140 lbs.
Weight of saw with cast iron table and legs (net).....290 lbs.

Workace 4-inch Planer

Will joint stock 4" wide at a maximum depth of $\frac{1}{8}$ ". G.E. motor turns 3600 r.p.m. under load and is direct connected to cutter through flexible coupling. Either 110 V.D.C. or 110 V.A.C. 60 cycle motor furnished; other ratings on request. V-groove pulley can be supplied in place of motor if desired. Cutter head accurately machined from solid steel has three high speed steel knives each clamped by three screws. Tables are cast iron, accurately machined, mounted on slanting ways and easily adjustable by means of handwheels. Rear table has rabbeting ledge. Fence, adjustable to any angle up to 45° is fastened to

front table. A special aluminum flap guard which is extra is recommended for schools. 10' cord and attachment plug is included.



Specifications

Length of knives.....4"
Depth of cut (maximum)..... $\frac{1}{8}$ "
Length of each table.....10"
Length of Workace 4" planer over all.....20"
Speed of motor or cutterhead.....3600 R.P.M.
Size of motor D.C. or single phase A.C..... $\frac{1}{4}$ H.P.
Number of knives in cutterhead.....3

Workace 14-inch Bandsaw

A quality bandsaw built in a small size for bench operation. Cast iron wheels, treated to prevent distortion are rubber tired and crowned to make blade track. Upper wheel adjustable for tension and mounted on spring to take strain from blade. One roller bearing guide above



table is adjustable vertically. Saw will take 6" cut under guide. Pulley on lower wheel takes standard Workace V-groove belt. Steel guards cover both wheels and saw travels in deep groove along the goose neck at the rear. Motor (not included unless ordered) is $\frac{1}{4}$ H.P. G.E. 110 Volt A.C., 50 or 60 cycle.

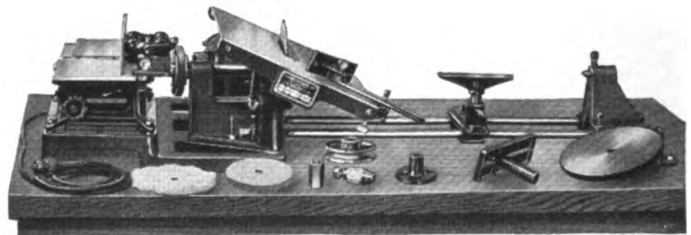
Specifications

Diameter of band wheels.....14"
Maximum space under guide.....6"
Length of saw blade.....7' 7"
Minimum power required..... $\frac{1}{4}$ H.P.
Height of machine over all.....40"
Size of table.....13" x 13"
Weight of Bandsaw (net).....90 lbs.

Workace Woodworker

A complete bench workshop consisting of a 4" Planer, 8" Circular Saw, 6" x 36" Lathe, 8" Disc Sander, 6" Buffing Wheel, 5" Emery Grinder, $\frac{1}{4}$ " Drill Chuck, and $\frac{1}{4}$ H.P. G.E. 110 Volt A.C. motor.

Planer is identical with the 4" Workace Planer described on this page.



Circular Saw has accurately ground tilting table which is adjustable to height, combination rip and crosscut fence, extra heavy rigid mandrel and combination rip and crosscut saw blade.

Lathe consists of two steel base rods with yoke at tail end, tail stock, 6" adjustable tool rest and live center screw chuck.

Grinding, Sanding, Buffing, and Drilling Attachments include 5" x $\frac{1}{4}$ " emery wheel, 8" sanding wheel, 6" buffing wheel, $\frac{1}{4}$ " drill chuck and grinder work rest.

Jig Saw Attachment which is included only as extra equipment quickly converts the Circular Saw into an efficient jig saw. Clamps onto lathe bed by means of a single screw. Does all light scroll sawing without removing blade for inside work. Complete with 6 assorted blades.

Workace Jig Saw

Ready Feb. 1st. A popular priced machine; high grade construction. Capacity 12" with goose neck; 2" thickness. Goose neck removable giving unlimited width capacity, using Sabor blade. Table tilts 45° either way.

Oilstone Tool Grinder

A popular priced machine. Direct drive, operates from light circuit.

The John T. Towsley Mfg. Co.

Division of J. D. Wallace & Co.

General Sales Office: 134-158 S. California Ave., Chicago

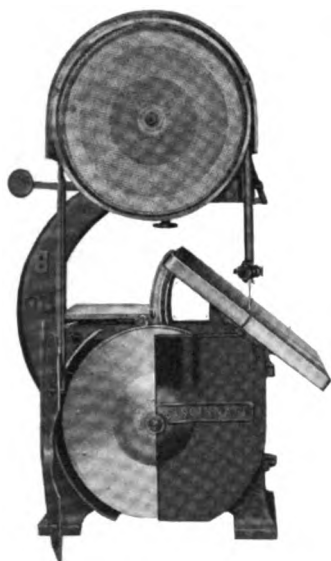
Factory: Cincinnati, Ohio

Manufacturers of

Towsley Woodworking Machinery

TOWSLEY Woodworking Machines are designed and built to fit the exacting requirements of men who seek the utmost in value for their investment—years of uninterrupted service free from high main-

Towsley Band Scroll Saw



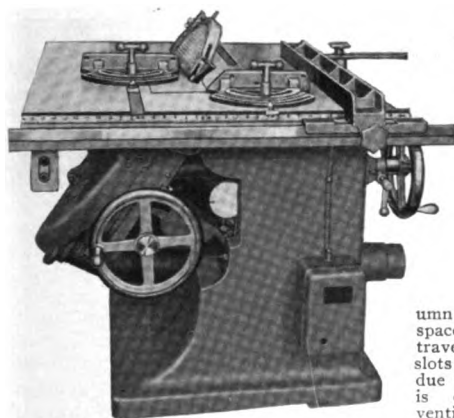
The TOWSLEY Band Scroll Saw contains many individual features which have made it one of the most popular in industry. The wheels are aluminum disc with demountable rims. The tires are dove-tailed and vulcanized into the rims, the wheels are lathe turned. The table locks directly against the column of the machine, avoiding links and joints. The indicator is on the outer edge of the table with degree marks $\frac{1}{4}$ " apart which makes for easy and accurate adjustments. All bearings are ball bearings.

The machine is completely guarded, adjustable guard above guide. All adjustments are made from the front of the machine.

Specifications

Diameter of wheels, inches.....	36"	42"
Maximum space under guide.....	20"	24"
Speed of Motor, R.P.M.....	600 to 1200	600 to 900
Blade travel, feet per minute.....	5500 to 11,000	6500 to 10,000
Height of table from floor, inches.....	41	41
Height of machine, overall, feet.....	8	8' 9"
Size of Table, inches.....	36x36	36x36
Size of Side Table, inches.....	17x18	17x24
Floor space required, inches.....	36x63	36x71
Weight of machine with pulley for belt drive, lbs.....	1900	2100
Weight of machine with motor, lbs.....	2100	2300

Towsley No. 1 Tilting Arbor Saw Bench



The Towsley No. 1 Tilting Arbor Saw Bench is so easy to adjust that a child can tilt it to any angle or raise or lower; the balance is perfect. The controls are in the front of the machine so that the operator may hold the stock with his right hand and shut off the machine with his left. A dust chute is built into the column requiring minimum space. Cross-cut guides travel in newly designed slots to prevent inaccuracy due to wear. The motor is equipped with two ventilator fans, one at each end. Small diameter of motor permits use of

smaller, less expensive blades, dado head, etc.

Specifications

Depth of cut with 14" blade—3" with 20" blade.....	6"
Diameter of Saw Mandrel (spring cone will center up to $1\frac{1}{2}$ " hole).....	$1\frac{1}{4}$ "
Speed of motor and saw blade, R.P.M.....	3600
Size of motor, regular, H.P.....	5
Vertical adjustment of motor, inches.....	4
Size of table, inches.....	42x36
Distance front edge of table to center of saw, inches.....	20
Floor space required.....	44x44
Net weight of machine with motor, lbs.....	1250

tenance cost and the expense of replacing.

TOWSLEY Woodworking Machines are built for those who choose equipment wisely, on the basis of lowest cost after years of satisfactory service.

Towsley Jointer

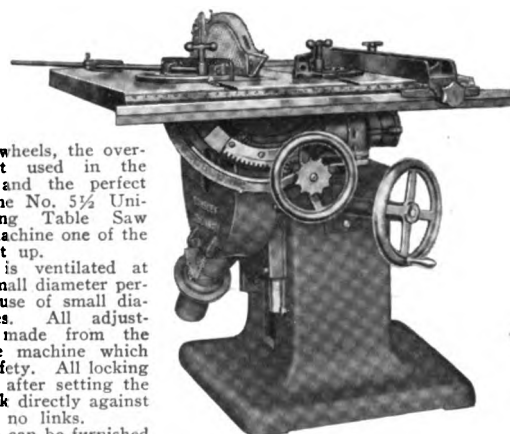


Like all Towsley machines, the Jointer is also noted for its extreme accuracy and high speed, long satisfactory service at minimum expense. The Towsley Jointer tables are mounted on four inclined ways, each of which are adjustable to maintain accuracy. These ways are mounted at all four corners, leaving no part of the tables suspended without direct support. The machine is ball bearing throughout.

Specifications

Number of knives—regular.....	4
Depth of cut, maximum, inches.....	$\frac{3}{4}$
Cutting circle diameter, inches.....	5
Opening between tables when making $\frac{1}{8}$ " cut.....	$1\frac{1}{8}$
Length of tables, inches.....	42
Length of machine overall, inches.....	88
Height of tables, inches.....	$34\frac{1}{2}$
Speed of motor and cutter head, R.P.M.....	3600
Size of machines, inches.....	12" 16" 20" 24"
Size of motors, H.P.....	2 2 or 5 5 5 or 7½
Floor space, belt drive.....	30x88 34x88 38x88 42x88
Floor space, motor drive.....	38x88 42x88 46x88 50x88
Weight of machine, belt drive (no countershaft), lbs.....	1300 1500 1700 1900
Weight of machine, motor drive.....	1400 1600 1800 2000

Towsley No. 5½ Universal Tilting Table Saw



Large hand wheels, the over-size segment used in the adjustment, and the perfect balance of the No. 5½ Universal Tilting Table Saw makes this machine one of the easiest to set up. The motor is ventilated at both ends, small diameter permitting the use of small diameter blades. All adjustments are made from the front of the machine which makes for safety. All locking devices used after setting the machine work directly against the column, no links. The machine can be furnished for belt drive.

Specifications

Depth of cut with 14" blade—3" with 20" blade.....	6"
Diameter of saw mandrel (spring cone will center up to $1\frac{1}{2}$ " hole).....	$1\frac{1}{4}$ "
Speed of motor and saw blade, R.P.M.....	3600
Size of motor, regular, H.P.....	5
Vertical movement of table, inches.....	6"
Size of table, inches.....	42x36
Distance front edge of table to center of saw, inches.....	20
Floor space required.....	42x41
Net weight of machine with motor, lbs.....	1250

The John T. Towsley Mfg. Co., 134-158 S. California Ave., Chicago, Ill.

American Saw Mill Machinery Company

Hackettstown, New Jersey

New York Office, 50 Church St.

Philadelphia Office, Bourse Bldg.

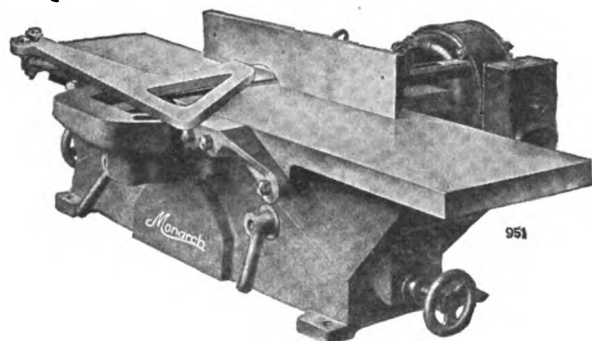
Manufacturers of

Woodworking Machines and Allied Lines

This Company is engaged in five distinct branches of manufacture, viz., Woodworking Machinery, including Lathes, Planers, Jointers, Band Saws, Resaws, Sanders, Mortisers, Saw Tables, etc.; Saw Mill and accessory equipment for lumber manufacturing; Contractors' equipment including Contractors' Saws and Hoists; Circular Saws of all sizes; Grinding equipment for knives of all kinds, Lawn Mower Grinders and Saw Sharpeners for circular and band saws. The machines described herein are more particularly adapted for use in manual training schools.

Monarch Bench Jointers

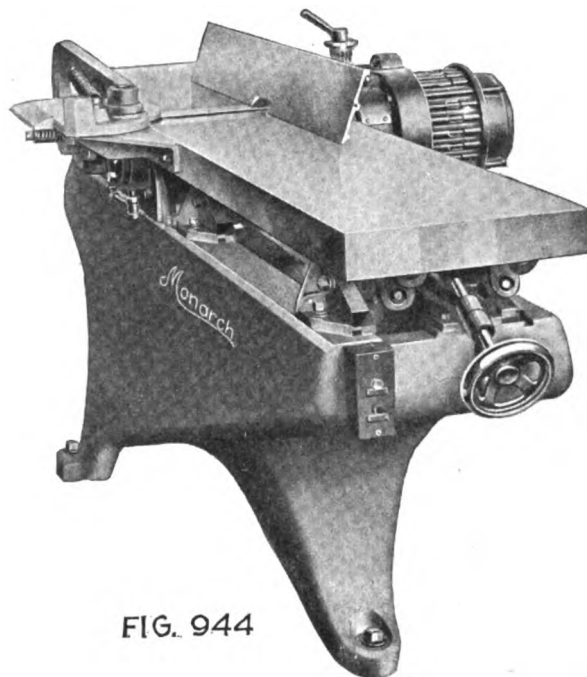
Bench jointers are made in six and eight-inch sizes, with safety round heads and high speed steel knives. They have all of the adjustments of large jointers and are built with exceptionally long, rigid tables and are guaranteed



for close work. These machines are furnished with ball bearings and for belt drive from motor or with direct connected motor, single phase, three-phase or direct current. This machine is furnished also with floor pedestal.

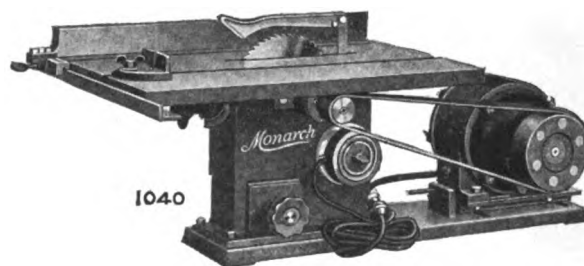
12" and 16" Ball-Bearing Jointers

A new design of jointer embodying the ideas of eminent woodworking experts and designers. Three point floor contact gives clear foot room for operator. Feed in table 48 in. long; feed out table, 36 in. long. Safety guard adjusts itself to any width of work passing through. Entirely out of way for rabbeting without removing from machine. Fence actuated by cut rack and pinion and can be clamped in place. Tilts to any angle from 45 deg. to vertical. Head is direct motor driven; is 5 in. in diameter, of improved design and fitted with three high-speed knives.



Principal dimensions—89 in. length overall; 38 in. width overall, including motor and rabbeting arm; 44 in. width overall for 16-in. jointer; $\frac{5}{8}$ in. depth of rabbeting groove; weight of 12-in., 1,600 lbs.; of 16-in., 2,000 lbs.

8" Ball Bearing Bench Saw No. X17



Weight 240 lbs.

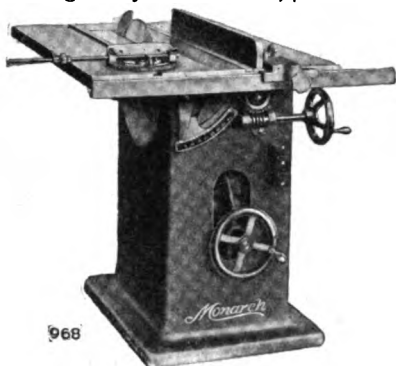
Here is a woodworker's precision machine with solid cast table 18 by 24 in., which tilts to any angle up to 45 degrees; locked by means of a convenient hand wheel at the side of the pedestal. The table is raised and lowered by means of another hand wheel which is also located at the side of the pedestal. The raising and lowering device operates through bevel gears and screw which provide accurate setting to regulate the depth in grooving or rabbeting work. The table has a rise and fall of $2\frac{1}{4}$ in., the saw projecting through the table $2\frac{1}{4}$ in. at its highest point. The saw furnished is a combination rip and cut off saw, 8 in. diameter.

American Saw Mill Machinery Company, Hackettstown, New Jersey

American Saw Mill Machinery Company—Continued

Tilting Table Motorized Variety Saw

The table is 38"x44" and tilts to 45 degrees. It is fitted with rip and cut-off guides with adjustable length gauge. The motorized arbor has height adjustment of $3\frac{3}{4}$ ". There are convenient hand wheels for adjusting the table and the saw. One 16" saw is furnished with each machine. Saw speed is 3450 R. P. M. Weight of machine with motor, 1000 lbs. This machine is also furnished with countershaft for belt drive or with motor mounted on base and belted to arbor.



Bench Band Saws

The accompanying illustration is of our 12" Bench Band Saw with motor drive and fitted with Safety wheel guards and roller saw guide.

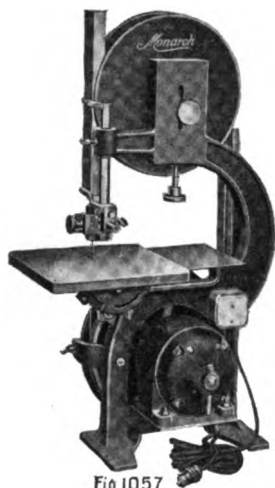


Fig 1057

This is a precision machine, constructed with great care, and is fully warranted to be a high-class machine.

We also furnish the same type of machine with 16" wheels, a larger machine of exceptional quality; also 20", 27" and 36" standard Band Saws with safety appliances to comply with all requirements.

This machine is also furnished with pulley for belt drive.

No. X 1 Hollow Chisel Mortiser

A small sized mortiser admirably suited for school work because of its simple, sturdy construction, simplicity of adjustment and ease of operation. The improved vertical motor head slides on accurately machined gibbed ways and is properly counterbalanced. The bit spindle is direct connected to the motor shaft and thrust is amply taken care of by special motor bearings. Takes hollow chisels up to $\frac{3}{4}$ " and bits of the same diameter. Will mortise $3\frac{1}{2}$ " deep with $\frac{1}{4}$ " chisel in hardwood, or with $\frac{5}{8}$ " bit in soft wood; will bore 4" deep with $\frac{3}{4}$ " bit. Table slides up and down, in or out and right or left; tilts 45 degrees right or left. Takes work 13" high on the table or 30" high with table removed. Due to sturdy construction and accurate balance, this machine is smooth-running and practically vibrationless—an ideal machine for student instruction.

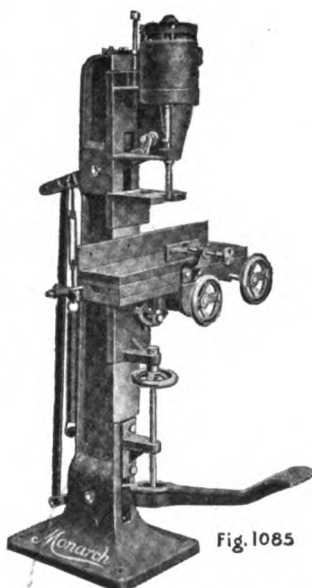
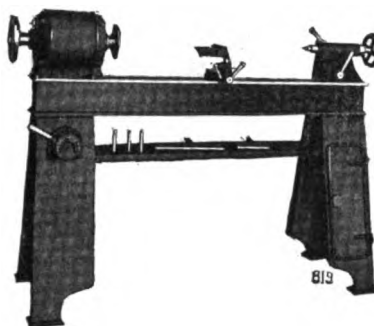


Fig. 1085

Manual Training Lathes

These machines are made in two types, one with motor head stock and the other with motor in the leg of the machine. The sizes range from 24" to 72" center and all are 12" swing. They are furnished with plain rest or with hand feed carriage and compound tool rest. Head stock lathes are for 3-phase, 60 cycle, 220 volt current only and have four speed changes. Lathes with motor in leg can be supplied with motor for any standard current.



Equipment

One $\frac{3}{4}$ " spur center; one $\frac{1}{2}$ " cup center; one conical center; one $2\frac{1}{2}$ " screw chuck; one 6" face plate; one 6" angle rest; one 12" T rest; one drift rod. Belt is furnished with belted lathe.



The one handle control and belt-shifting device of the motor-in-leg lathe eliminates all hand shifting. Handle can be moved instantly from one notch to another and speed changes effected.

Dimensions and Weights of Lathes

Length of bed.....	50"	62"	71"	74"	89"	99"
Distance between centers.....	24"	36"	42"	48"	60"	72"
Shipping weight, with Motor.....	900	940	960	980	1020	1125
Shipping weight, less Motor.....	820	860	880	900	940	1050
Weight with Motor Headstock.....	840	880	900	920	960	1070

Ball Bearing Drum and Disc Sander

Although but recently introduced, the new Model X8 Sander has met with unusual favor. It is compact, simple, sturdy, reliable and everything else the school machine should be—and it is a real production tool. May be had either as a Combination Drum and Disc Sander or as a Drum Sander alone. There are no exposed moving parts except the working surfaces of the disc and drum. Drum is 10" in diameter x 16" long; disc is 18" in diameter. Both are mounted on one shaft and turn 1,600 R.P.M. underload. Both tables are fully adjustable and facilitate the widest range of work. Motor is fully enclosed within the column and carefully protected by a dust shield. Belt tension is automatically maintained. Completely equipped with approved starting device, belt, guards, miter gauge and face plate for small cylinder sanders.



The American Saw Mill Machinery Company are also manufacturers of swing cut-off saws of either wood or metal frames and either direct motor drive or belt drive—combination rip and cross-cut power saws—variety woodworkers combining saw, jointer, mortiser, borer, and also band-saw, equipped either with power built in or without—universal saw benches with saws up to 14 in. in diameter—tilting table bandsaws 20, 27, 30, and 36-in.—single and double spindle shapers—tenoners—post boring machines and planers or surfacers of 16, 20 and 24-inch width.

J. G. Blount Company

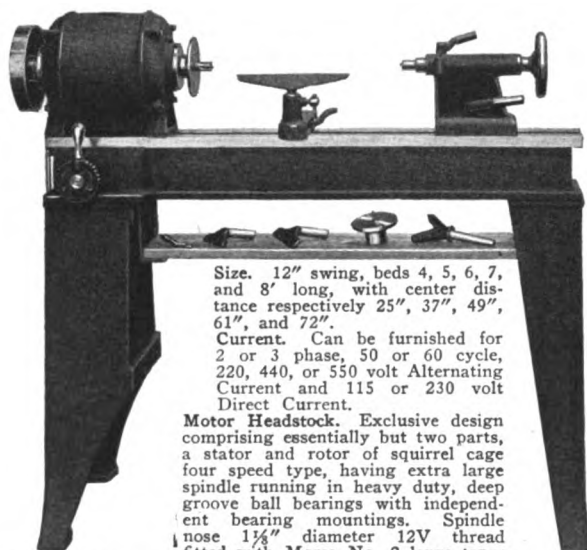
Everett, Mass.
Manufacturers of

Blount Lathes and Grinders

Blount Lathes and Grinders are today the result of a consistent policy of limiting production to but two products. This specialized attention to every detail of construction and the service these tools must always render has achieved the latest and most improved design in Blount Products. Such a policy assures users of long satisfactory service.

Characteristic of all Blount Products is their rigidity, freedom from vibration, safety and convenience in operation. To this end exceptional weight is built into all parts, extra large bearings are provided, fully enclosed motors and proper guards are used and the design is such as to assure accessibility and rapid easy production.

½ H.P. A.C. or D.C. Motor Headstock Lathe



Size. 12" swing, beds 4, 5, 6, 7, and 8' long, with center distance respectively 25", 37", 49", 61", and 72".
Current. Can be furnished for 2 or 3 phase, 50 or 60 cycle, 220, 440, or 550 volt Alternating Current and 115 or 230 volt Direct Current.

Motor Headstock. Exclusive design comprising essentially but two parts, a stator and rotor of squirrel cage four speed type, having extra large spindle running in heavy duty, deep groove ball bearings with independent bearing mountings. Spindle nose 1½" diameter 12V thread fitted with Morse No. 2 large taper

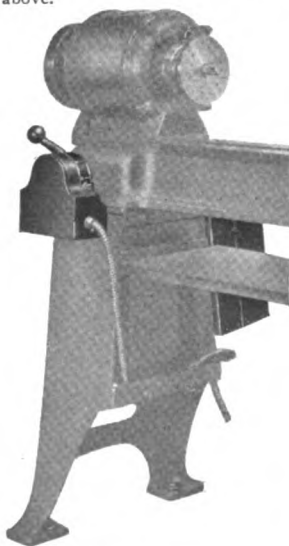
for extra large work centers. Head-stock fully enclosed by heavy end-shields having double protection against dust and dirt. Controller. Fully enclosed, dust proof and mounted in special large headstock leg protected from mechanical injury. Operation by convenient handwheel with four running positions providing spindle speeds of 575-1160-1725-3450 RPM. All wiring between motor headstock and controller is done before shipment. Beds. Extra heavy, cross-braced, with flat top 6¼" wide carefully machined and milled inside and out and scraped. Sizes furnished as

Tailstock. Heavy, rigid in design, of open side type—base 6¼"x7½", with bearing for spindle 8" long. Spindle 1½" diameter fitted with Morse No. 2 large taper. Binding levers are large and easily accessible. Rest Holder is large and clamps quickly and securely by quarter turn of hand lever.

Equipment. One cup and one spur center, three turning rests 4-7-10", one right angled rest, 6" inside faceplate, 8" combination hand-wheel and rear faceplate, 3" screw chuck, spanner wrench, knockout rod and blueprint holder.

As designed, this lathe when connected directly to current supply without use of any type of cutout switch is entirely safe. To start, the controller handwheel is moved from "full stop" position to required speed. To stop, the handwheel must be returned to "full stop" position, at which point the motor is completely disconnected. The motor cannot be stopped with the controller left in speed. All control being in the hand-wheel there is no necessity for a push button start and stop station.

(Where a special cut out switch is desired—see our Automatic Starter described below.)

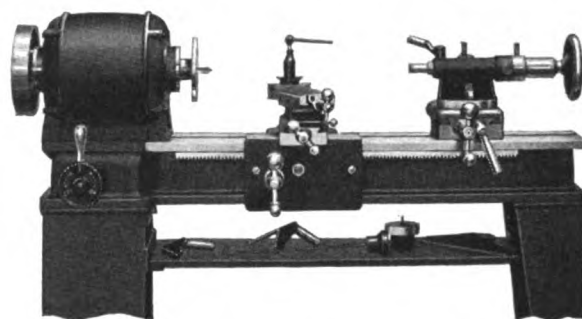


"Blount"
J.G. BLOUNT CO. ESTD 1888

Automatic Starter

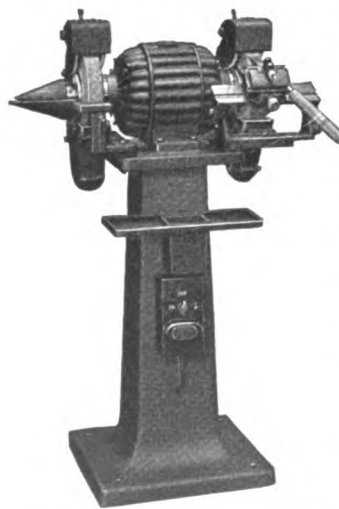
Where full protection for the motor as well as absolute safety of the operator is desired the Blount Automatically Controlled Starter affords the latest and most approved device. The starter having both overload and low voltage release protects the motor in every way against possible damage. The exclusive automatically operated push button start and stop station is fully enclosed, beyond the reach of either the careless or mischievous student who is thereby practically eliminated in the operation of the lathe. At the "full stop" position the motor is fully disconnected from current supply. In moving the controller handle to first speed the starting switch is automatically set connecting motor to the line. Desired speed is then progressed to. In stopping, the controller handle is brought back through each speed to "full stop" position. After leaving the first speed the stop button is automatically compressed, thus fully disconnecting motor from current. It is thus impossible to stop lathe with motor left in speed. If from an overload or sudden drop in voltage or even the complete cutting off of current from other than operator's cause, the lathe should stop, it cannot again be started until controller is brought back to "full stop" position and started in usual manner. This device thus assures full electrical protection for motor; the automatically operated starter eliminates the danger from careless operation, and danger from events beyond operator's control are eliminated. Safety is assured.

½ H.P. A.C. or D.C. Motor Pattern-Makers' Lathe



This lathe is in all respects the same as that described above with the exception of the bed. A special extra wide top, heavy bed is used for the proper mounting of hand feed rack and pinion carriage. The Carriage is of very sturdy design carefully machined, and fitted by hand to the bed. The Compound Rest is of like design, well gibbed, with parts fitted accurately by hand. The full Setover Swivel Tailstock is of sturdy design, carefully and accurately assembled. The swivel base can be revolved full 360° to permit any degree of taper for boring or turning. A taper pin makes realignment quick and accurate. The cross feed travel is 4" each side of lathe center. A hand screw makes possible quick setover. Tailstock is fitted with patented screw and hand lever feed for rapid boring operation. All binding levers are sturdy to prevent breakage and all conveniently placed above the ways. For all kinds of pattern-making in either wood or metal, this lathe is especially adapted, powerful, rigid, vibrationless and easily operated.

All Purpose Tool Grinder



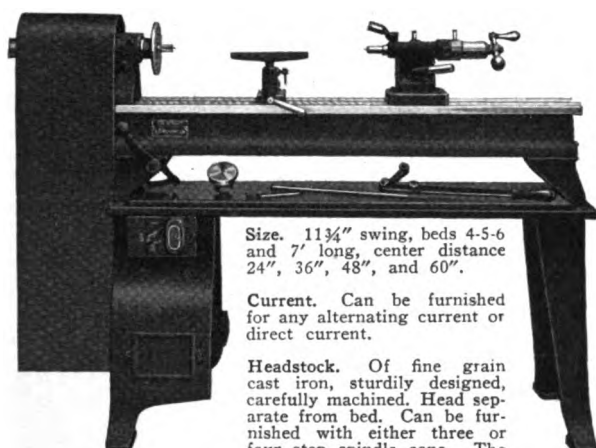
This grinder has been developed to meet all classes of grinding service, both for edge tools and general rough snagging. It is therefore an especially essential tool in either the wood or general shop.

In principal features of mechanical construction it is the same as the A.C. Ball Bearing Motor Grinder, described on the next page. The motor is fully enclosed. The spindle is large and runs in heavy duty ball bearings. It is completely guarded and safe. On the left side there is a grinding cone for curved edge tools and also a wheel for general rough grinding. To the right wheel, which is especially adapted for grinding tools, has been added an adjustable rest with a sliding clamp block for holding tools. The rest is easily set for correct angle and curvature and the hand screw feed of clamp block assures easy, rapid, and accurate grinding. This machine is built in three sizes with ½, ¾ or 1 H.P. motor.

J. G. Blount Company, Everett, Mass.

J. G. Blount Company, Continued

$\frac{1}{2}$ H.P. Motor Under-Drive Lathe



Size. $11\frac{3}{4}$ " swing, beds 4-5-6 and 7' long, center distance 24", 36", 48", and 60".

Current. Can be furnished for any alternating current or direct current.

Headstock. Of fine grain cast iron, sturdily designed, carefully machined. Head separate from bed. Can be furnished with either three or four step spindle cone. The spindle is extra large bored throughout and has Morse

No. 2 large taper. Spindle nose diameter, $1\frac{3}{4}$ " 10V-thread. Either self-oiling phosphor bronze bearings or heavy duty deep groove ball bearings can be furnished. Cone is carefully finished, accurately balanced, and pressed on spindle, there being no set screws used.

Motor. Motor is mounted in cabinet type leg, fully enclosed and is of constant speed type, mounted on hinged shelf having outer bearing supporting motor shaft. The cone is pressed on special extension shaft, mounted and keyed to motor shaft. The motor shelf is easily adjustable for belt tension.

Tailstock. Same as on the $\frac{1}{4}$ HP. Direct Current Motor Headstock Lathe.

Beds. Of same general construction as those of direct current lathes with the exception that bed is cast with an extension for proper support of headstock. Sizes as above. Bed is mounted on bench legs on a flat pan supported by lathe legs. On pan is mounted wooden shelf for protection of tools.

Belt Guard of welded, steel construction, fully enclosing headstock end of lathe assures safety.

Belt Shifter is a simple lever and link mechanism and hence is very easily operated with but slight effort. It consists of a sliding block moving on polished guides supported in the head end leg. On the block are mounted the shifter fingers between which the belt runs. The hand lever mounted at the front of the lathe handy to the operator is connected by links to the sliding block. The lever and links are of such length as to insure ease of shifting. A notching device is employed to hold the shifter in its various positions.

Equipment. Same as for other lathes.

Improved Wet Tool Grinder



For the wet grinding of all tools to prevent burning Blount Wet Tool Grinders are indispensable, in either wood or metal shops. They are of simple design and very rugged construction with large line-reamed self-oiling babbit bearings throughout. The vertical centrifugal pump is friction driven, eliminating all belts. Bearings on pump spindle are on yoke—within pump there are no bearings and the ample clearance of impeller eliminates all possibility of wear. A sleeve cap covering the pump case extends above water line in base thus preventing leakage, eliminating necessity for packing. The flow can be regulated by

conveniently placed valve. Can be furnished either belt or motor drive. Proper guards used on motor-driven units. Made in three sizes for $14"x1\frac{1}{2}"$, $20"x2\frac{1}{2}"$, and $30"x3"$ wheels.

"Blount Special" Motor Grinder

An inexpensive high quality motor grinder for tool or general grinding in all shops. Motor is fully enclosed, guards are adjustable to wear of wheel, fitted with two $6"x\frac{3}{4}"x\frac{1}{2}"$ wheels, tool rests, indicating snap switch, cord and plug with handle for portability. All parts thoroughly machined and rigidly assembled. Smooth and vibrationless in operation. If desired can be furnished with special wide rest adjustable to angle with wheel. Weight 50 lbs.

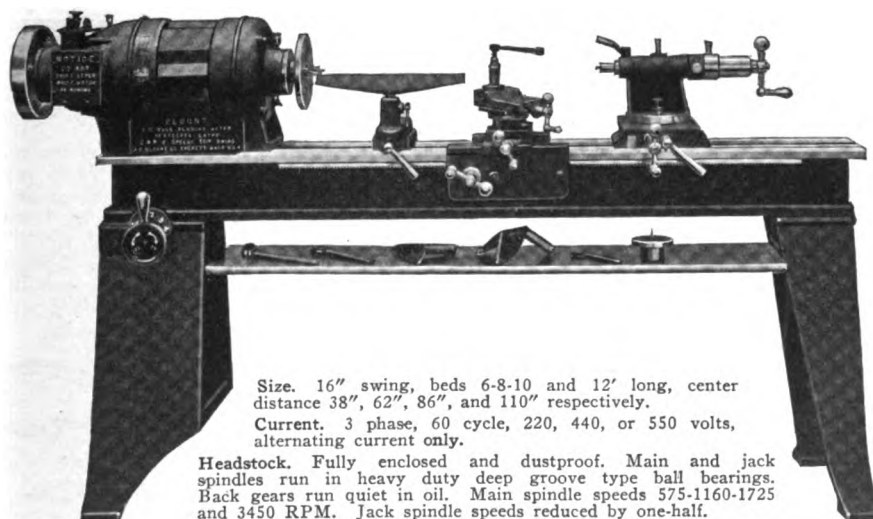


A. C. Ball Bearing Motor Grinder



For general tool or snagging grinding in all shops. Motors are fully enclosed and dustproof. Spindles are of carbon steel, large and run in heavy duty deep groove ball bearings which are fully protected from dust by double felt packings. Flanges are large, machined all over and recessed on inside. The tight flange is specially designed, and recessed into motor housing to form an additional seal against dirt. Guards are fully enclosing, adjustable and have exhaust outlets. Regular equipment includes heavy duty snap switches. Where desired automatic starters can be furnished. All parts are of exceptionally rugged construction, carefully machined and assembled, smooth, vibrationless and economical. Can be furnished from $\frac{1}{4}$ to 5 H.P., bench or floor type, for alternating current only.

2 H.P. A. C. Motor Headstock Pattern-Maker's Lathe



Size. 16" swing, beds 6-8-10 and 12' long, center distance 38", 62", 86", and 110" respectively.

Current. 3 phase, 60 cycle, 220, 440, or 550 volts, alternating current only.

Headstock. Fully enclosed and dustproof. Main and jack spindles run in heavy duty deep groove type ball bearings. Back gears run quiet in oil. Main spindle speeds 575-1160-1725 and 3450 RPM. Jack spindle speeds reduced by one-half.

Equipment. Same as for $\frac{1}{4}$ HP. Alternating Current Pattern Makers' Lathe.

This lathe is designed for all round pattern-making in either metal or wood. Its outstanding advantage is the wide range of speeds offered. For large diameter rear faceplate work a gear reduction has been incorporated. Gears can be disengaged at will and run quietly in oil bath. The bed is extra heavy with vee ways. Similar in design to the $\frac{1}{4}$ HP. Pattern Makers' Lathe, but of heavier construction are the hand feed carriage, compound rest and full setover swivel tailstock. Of highest standard of workmanship throughout, with all parts ruggedly constructed, convenient and safe in operation this lathe is an outstanding tool of most improved design.

Henry Disston & Sons, Inc.

Philadelphia, U. S. A.

Canadian Factory: Toronto
Manufacturers of

Saws, Files Bench, and Machine Tools

There is no substitute for Disston quality in a saw, tool or file. Disston Steel and Disston Skill gave Disston leadership as saw makers to the world. Disston Steel, from Disston's own steel furnaces, is the world's great cutting steel. It has edge-holding qualities that only Disston's 90 years' experience as saw makers and as steel makers can put into steel.



Disston Saws, Tools, and Files are used in school shops throughout the world. When you specify "Disston," you insure better work and longer service. The Disston Educational Department always is ready to co-operate with instructors. Reliable hardware dealers in your city will give you school quotations and prompt delivery on all Disston tools.

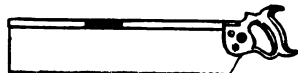


A 24-bench shop should have 9 cross-cut, 22" or 24", and 6 rip, 24". We recommend D-8 Regular Pattern (skew back), D-16 and D-7 Regular Pattern (straight back).

Hand Saws. Disston Hand Saws hold up longer under shop use. True-taper ground. Made of Disston Steel with Disston Temper. Disston handles, with perfect balance.

Back Saws. Disston Back Saws have heavier bright-steel backs, to keep blades down in cut, and thin blades of Disston Steel. Comfortable handles for easy, smooth cutting, with Disston weather-proofed finish.

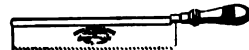
Dovetail Saws. A handy shop tool for fine work. Extremely thin blade (.018") with 17-pt. teeth. Steel back, brass plated.



No. 4 Mitre Box Saw. 20" and 22" are 4" under back; 26", 28"—5" under back; 30", 32"—6" under back. Specify a Disston Saw for your mitre box.



No. 4 Back Saw, 12" long, 3" under back, 14-pt., is most popular for school use. One for each bench.

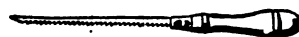


No. 68 Dovetail Saw, 6", 8" or 10" long. Order two for fine cutting.

Mitre Box Saws. Disston No. 4 have extra heavy polished steel backs and blades of Disston Steel, with edge holding Disston Temper. They are accurate and easy-cutting. Blades toothed 11 points to the inch.



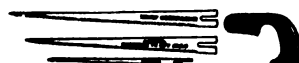
No. 2 Compass—10", 12" and 14".



No. 95 Keyhole Saw and Pad—10".



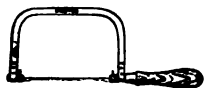
No. 10 Keyhole Saw and Pad—7".



No. 7 Nest of Saws—10" keyhole blade, 14" regular compass blade; and 14" compass blade tempered to cut nails in wood.

Compass and Keyhole Saws. A 24-bench shop usually has 6 Disston Compass Saws, 3 Disston Keyhole Saws, and 2 Disston Nests of Saws, chosen from the numbers illustrated.

The No. 95 Keyhole Saw is especially popular, as adjustment of the blade length in the wooden handle prevents buckling in starting cuts. All of these Disston Saws have teeth suitable for cutting all curves. Made of Disston Steel.



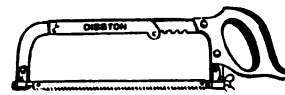
Twelve No. 10 Coping Saws and three gross of extra blades are needed for 24 benches.

Coping Saws. Disston Coping Saws have sturdy Disston Steel backs and knurled stretchers with pins for quick adjustment. Frame 4½" deep to inside of blade. Maple handles. Blades 6½" from pin to pin. Extra blades available.

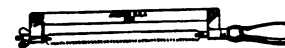
Practice Filing Pieces. Disston Practice Filing Pieces will enable you to teach the correct method of setting and filing saws.



Made 2½"x6", toothed, but not set or filed.



No. 36½ Hack Saw Frame.



No. 200 Hack Saw Frame.

from tooth edge to inside of blade. Takes 8" blades. Excellent type for elementary metal work.

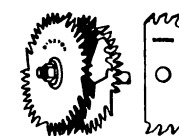
Hack Saw Blades. For hand frames, specify Disston Chromol (all-hard) or Disston Duraflex (flexible) blades. Duraflex blades resist breakage better when used to cut thin brass, aluminum, tubing, etc. Disston Chromol and High-Speed Steel Machine Hack Saw Blades are suitable for general use. A Disston High-Speed Steel Machine Hack Saw Blade will outlast many ordinary blades.



Disston Narrow Band Saws.

correct gauge for any sized wheel. Specify width and length. Give size of machine in ordering and specify width and length of blade needed.

Disston Circular Saws. Disston makes every type, style and size of circular saw, for use on your machines. School saws from 4" to 16" in diameter. Disston Combination Saws, which cross-cut, rip, and mitre equally well, are favorites in school shops everywhere. The Disston Smooth-Cutter Saw is hollow ground, and makes a joint smooth enough for gluing, without sanding. All Disston Circular Saws are made of Disston Steel, famous for hardness, toughness, temper.



Disston Groover.

Saw Sets. The Disston Triumph Saw Set, No. 28, is ideal for use on hand, web and narrow band saws. The No. 18 is to be used on fine point circular saws, not over 14-gauge. The No. 280 is for saws toothed finer than 9 points; back saws, etc. All are of double-plunger type, with four bevels on anvil.



Disston Triumph Saw Set
No. 28 for Hand Saws, Band Saws.
No. 280 for Back or fine-point saws.
No. 18 for Circular Saws.



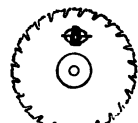
Disston Hand Hack Saw Blades.



Disston High-Speed Steel Machine Hack Saw Blades.



Disston Circular Rip Saw



Disston Circular Combination Saw

Groovers. Disston No. 30 Groovers or Dado Heads will cut grooves of any width from ⅛" up to 4" wide, adjustable by sixteenths. Set No. 1 cuts from ⅛" to ½"; Set No. 2 from ⅛" to ¾", and Set No. 3 from ⅛" to 1". Diameters, 5" to 16". All give a smooth, square cut, either with or across grain. Easily set up for perfect grooving.

Henry Disston & Sons Co., Inc., Philadelphia, U. S. A.

Henry Disston & Sons Co., Inc.



Disston D-3 Filing Guide and Clamp.

Saw Filing Guide and Clamp. The Disston D-3, as illustrated, is a heavy, substantial saw clamp combined with a convenient filing guide. It is quickly adjusted for either rip or cross-cuts of any point. It enables the student to put the proper bevel on each tooth and learn the art of saw filing. Disston also makes the most convenient clamp for small circular saws.

Machine Knives. Disston Planer and Joiner Blades and Moulding Knives are standard in planing mills, furniture factories, etc. They are made in three types: Thin high-speed steel blade, Inlaid high-speed steel blade, and All-Carbon steel blade.

Files. Disston is the world's largest user of files. Disston Files, of Disston Steel, made in all styles and sizes, for every purpose, are sharp, accurate, dependable, lasting! Every one has a perfect cutting surface, the correct temper, and the hardness that insures longer service. Specify Disston Taper and Mill Files, Cabinet Files and Wood Rasps.



In ordering, specify length, width, thickness. If slotted, send paper template. For moulding knives, send template.

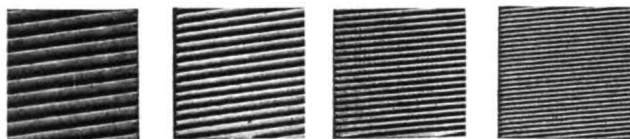


Disston Slim Taper and Extra-Slim Taper Files.



Disston Mill Files.

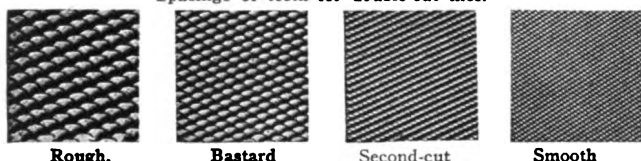
Spacings of teeth of single-cut files.



Rough. Bastard. Second-cut. Smooth.

Single-cut files have one course of chisel cuts diagonally across their surface. They are distinguished for their smoothness of cut. The single-cut files in general include: Taper Files, triangular in section, used mostly for hand-saw filing. Disston Taper Files are available in regular, slim, extra slim, extra-slim blunt and double-extra slim. Blunt Band Saw Files, with parallel sides. Mill Files, tapered in width and thickness; also made blunt; for filing circular saws, jointer and planer knives; also for lathe work, or any flat, smooth cut. Mill files can be ordered with one or both edges rounded. Round Files, tapered or blunt, single cut to 8" length, double cut if larger, used for enlarging holes, gumming circular saws, etc.

Spacings of teeth for double-cut files.



Rough. Bastard. Second-cut. Smooth.

Double-cut files have two courses of teeth, the second "upcut" over the first. They are used for fast cutting on bench and general work. Double-cut files in general use include: Flat Files, tapered in both thickness and width, double-cut on faces, single-cut on edge, one of the most widely used files. Half-round Files, one side arched, tapered in length and thickness, useful for general work. Square Files, for dressing out corners, cutting square holes, etc. Hand Files with parallel sides, tapered in thickness, one edge cut, one edge blank. Warding Files, unusually thin, tapered in width, for slotting.

File Card and Brush. The wire brush loosens the filings, permitting cleaning teeth of files with brush. Proper cleaning of files greatly lengthens their life. A File Card and Brush should be provided for all your metal shops.



Disston Marking Gauge, No. 83.

Marking Gauges. A Disston Marking Gauge is needed on every bench. The No. 83 is made especially for school use. It has an oval head, with a heavy spur of tempered steel. Made of cherry, inlaid with brass strips. Not graduated. No. 95 Mortise Gauge is made of boxwood with full plated brass head. Bar graduated. Screw adjustment in end of stock sets width of mortise.



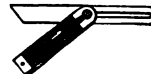
Disston Combination File Card and Brush.

Try Squares. Disston No. 5½ has toughened steel blade, graduated and numbered from head to end, with nickel-plated stock. No. 10 Mitre Square, graduated, has rosewood handle, and is made in 6", 7½", 9", and 12", with mitre angle. No. 11 Mitre Square is similar to No. 5½ Try Square, except that it has mitre corner angle. 8" is preferred. One to each bench.

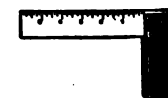
Bevels. Disston No. 3 Bevel has ball-bearing lock, which locks firmly at any angle. All metal. No. 2 has rosewood stock. One bevel is needed for each six benches. Specify 6", 8" or 10", 8" being preferred.



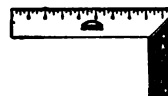
Disston T-Bevel, No. 3



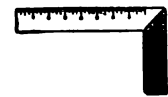
Disston T-Bevel, No. 2



Disston No. 5½ Try Square



Disston No. 10 Mitre Square



Disston No. 11 Mitre Square



No. 31 Cabinet Screw-driver

Screw-Drivers. The ideal assortment for 24 benches consists of 12 Disston No. 30 Screw-drivers and 12 No. 31 Cabinet Screw-drivers. No.

31 has an extra-thin blade for cabinet makers' use. All blades of Disston Steel, with Disston Temper, hard and tough.

Cabinet Scrapers. All Disston Cabinet Scrapers are made of Disston Steel, of the same high quality as used in Disston Hand Saws. They have edge-holding qualities that cannot be duplicated. Popular sizes in regular scrapers are 2½"x 5", 3"x 5" and 3"x 6", and six are needed for 24 benches. French models are made in same sizes, and Swan Neck models are made 3"x 5".



Disston No. 1 Cabinet Burnisher.

Cabinet Burnisher. Oval shape makes burnishing easy. Hard Disston Steel stands up without nicking or grooving burnisher.

Plumbs and Levels. The Disston No. 16, adjustable, 26" long, solid hardwood, brass ends, is a favorite in school shops. The A-10, made of airplane aluminum, length 9", weight less than 2 oz., with three proved glasses, is a dependable small level for setting joiner tables, shafting, etc.



Disston No. 16 Adjustable Plumb and Level.



Disston No. A-10 Feather-weight Pocket Plumb and Level.

Other Disston Tools. Disston makes metal-cutting saws of every type, trowels, and many other tools useful in the school shop. Write for full information about the tools or equipment in which you are interested.



Disston Tool Manual. Every instructor should have the "Disston Tool Manual for School Shops"—206 pages of practical information on the use and care of saws, tools and files. Sent free on request to us. Ask also for "The Disston Specification Folder," which saves your time in ordering school shop equipment.

Gallmeyer & Livingston Company

213 Straight Ave., Grand Rapids, Mich.

Manufacturers of

Union Woodworking Machinery

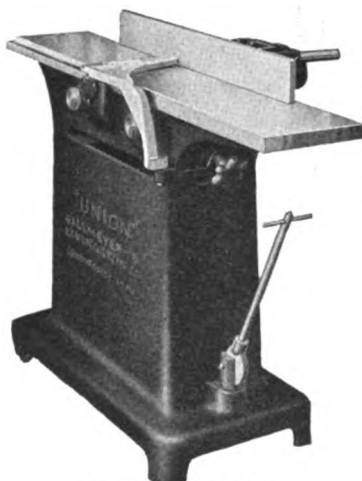
As most shop instructors have to crowd hours into minutes to adequately cover, in a semester, the most important phases of modern woodworking it is highly important that each student is given actual machine practice every time the class meets. With large cumbersome machines that is out of the question. The compactness—portability—low first cost and low operating cost of Gallmeyer & Livingston machines permit installing a sufficient number to give each student actual practice every time the class meets.

Gallmeyer & Livingston machines are the best machines for school use and hundreds of the best schools are using them.

All Gallmeyer & Livingston machines have direct motor drive and operate from power line or light socket—ball bearings throughout—safety guards—machines furnished in bench type—truck or stationary base as preferred. Specifications that follow give full details.

Hand Jointers

"Union" portable hand jointers will do all ordinary operations of which a larger machine is capable, including rabbeting, etc. Available in 6 in., and 8 in. sizes for either bench or column mounting.



Motor on the Arbor
8 in. Hand Jointer

The motors are ½ h.p. Full 1 h.p. motor may be had on the 8 in. machine if it is to do heavy work. Motors are integral part of machine—directly on the arbor.

Tables are adjustable in height by means of hand-wheel. Rabbeting groove in rear table. The fence may be set at any position and angle from square to 45 deg. Standard portable truck type base for floor mounting.

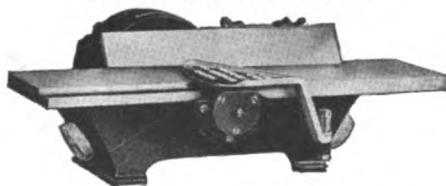
Approved safety cylinders carry three high-speed steel knives of special design. All machines have ball bearings. Automatic, fool-proof guards make the machine very safe for school use.

Eight-Inch Motor-on-Arbor Hand Jointer

Specifications

Width of Knives.....	8¼ in.
Length of Front Table.....	24 in.
Length of Rear Table.....	18 in.
Length Over All.....	44 in.
Motor.....	½ or 1 h.p.
Speed of Safety Cylinder.....	3600 r.p.m.
Number of Knives Carried.....	3
Net Weight—Bench Type.....	260 lbs.
Net Weight—Complete with Base.....	460 lbs.

Six-Inch Hand Jointer



6 in. Hand Jointer for Bench Mounting

Specifications

Width of Knives.....	6 in.
Length of Front Table.....	22 in.
Length of Rear Table.....	17 in.
Length Over All.....	40 in.
Electric Motor.....	½ h.p.
Speed of Safety Cylinder.....	3600 r.p.m.
Number of Knives Carried.....	3
Net Weight—Bench Machine.....	225 lbs.
Net Weight—Complete with Base.....	400 lbs.

Saw Benches

These Motor-on-Arbor Machines possess all the refinement and features of larger saw benches, and will do a job equal in every respect. For average work and particularly for the type of work usually done in a school shop they have distinct advantages over machines of larger dimensions.

The frames are stiff, strong, one-piece castings, which will rest firmly upon a bench without bolting.

Both cross-cut and ripping gauges may be used either side of the saw. The cross-cut gauge may be set and rigidly clamped at any angle. Ripping gauge is automatically locked in perfect line with saw blade when lever-head screw is tightened.

Adjustable saw guard protects the operator at all times and a splitter guard keeps the stock from pinching the saw. Where belts are used they are fully protected.

Metal throat plates are easily removable, allowing substitution of hardwood plates when using Dado or grooving heads.

No. 12 Motor-on-Arbor Universal Saw Bench

Will do any job intended for a first class universal saw bench. Table may be tilted to any angle up to 45 deg. and instantly locked. An accurately graduated dial indicates the exact position of the table at all times. Stops are provided to facilitate an accurate return to horizontal. Saw mounted on motor arbor. No gears or belts.

Can be furnished 50 and 60 cycle A.C. and 115 and 230 D.C. Not suitable for bench mounting.

Specifications

Diameter of Saw.....	12 in.
Depth of cut.....	2½ in.
Cross-Cuts.....	15 in.
Rips.....	13½ in.
Size of Motor.....	½ to 3 h.p.
Size of Table.....	30 x 34 in.
Speed of Saw.....	3600 r.p.m.
Net Weight.....	600 lbs.



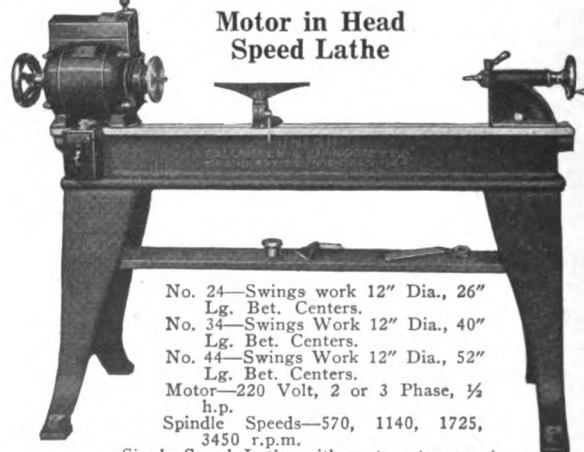
No. 10 Universal Saw Bench

The "Union" No. 10 Motor on Arbor Saw Bench is a high grade machine possessing all the refinement, universal features, and high grade design and workmanship found on any of the large machines on the market. In size only does it vary from the highest grade saw benches and for small work this smaller size is a distinct advantage.

Specifications

Size of Table.....	25 x 28 in.
Diameter of Saw.....	12 in.
Diameter Hole in Saw.....	1 in.
Depth of Cut.....	2½ in.
Cross-Cuts.....	12 in.
Rips.....	12 in.
Size of Motor.....	½ h.p.
Speed of Saw.....	3600 r.p.m.
Height—Bench Type.....	10 in.
Height—Complete with Base.....	36 in.
Net Weight—Bench Type.....	325 lbs.
Net Weight—With Base.....	375 lbs.
Crated Weight—Bench Type.....	280 lbs.
Crated Weight—With Base.....	450 lbs.
Code Word—Bench Type.....	Bensaw
Code Word—With Base.....	Comsaw

Motor in Head Speed Lathe



No. 24—Swings work 12" Dia., 26"
Lg. Bet. Centers.
No. 34—Swings Work 12" Dia., 40"
Lg. Bet. Centers.
No. 44—Swings Work 12" Dia., 52"
Lg. Bet. Centers.

Motor—220 Volt, 2 or 3 Phase, ½ h.p.

Spindle Speeds—570, 1140, 1725, 3450 r.p.m.

Single Speed Lathe with motors to operate from lighting current also furnished.

Gallmeyer & Livingston Company, 213 Straight Ave., Grand Rapids, Mich.

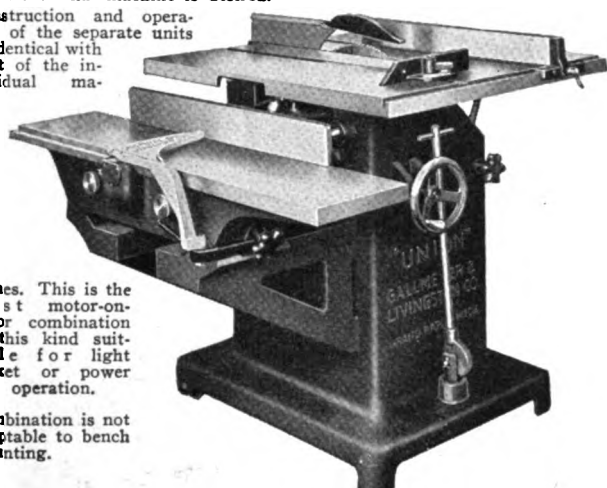
Gallmeyer & Livingston Company, Continued

No. 128 Combination Universal Saw and Eight-Inch Jointer (Motor-on-Arbor Type)

A single unit made by combining the No. 12 Universal Saw Bench and the Eight-Inch Hand Jointer. In the combination neither unit detracts from the other. Each part is just as efficient as a separate machine would be. Changing from one machine to the other is the matter of a few seconds; simply drop the saw to its lowest position and move the slip coupling to engage the coupling on the Jointer when the use of that machine is desired.

Construction and operation of the separate units is identical with that of the individual machines. This is the first motor-on-arbor combination of this kind suitable for light socket or power line operation.

Combination is not adaptable to bench mounting.



The Union No. 106 Motor on Arbor Tilting Saw and 6" Jointer

is a single portable unit made up by combining our No. 10 Motor on Arbor Tilting Table Saw with our 6" Jointer. Neither unit detracts from the other. Each is exactly as efficient as a separate machine.

Specifications

	No. 128	No. 106
Diameter of Saws.....	12 in.	12 in.
Depth of Cut.....	2½ in.	2½ in.
Cross-Cut Stock 1" Thick.....	15 in. wide	12 in.
Rip Stock 1" Thick.....	13½ in. wide	12 in.
Size of Motor.....	½ to 3 h.p.	½ h.p.
Size of Saw Table.....	30 x 34 in.	25 x 28 in.
Speed of Saw.....	3600 r.p.m.	3600 r.p.m.
Width of Jointer Knives.....	8¼ in.	6 in.
Length of Front Jointer Table.....	24 in.	22 in.
Length of Rear Jointer Table.....	18 in.	17 in.
Length Over All.....	44 in.	40 in.
Number of Knives Carried.....	3	3
Speed of Safety Cylinder.....	3600 r.p.m.	3600 r.p.m.
Net Weight.....	890 lbs.	350 lbs. Bench Machine 550 lbs. Complete with Base.

Crated Weight—Bench Machine.....	440 lbs.
Crated Weight—Complete with Base.....	650 lbs.
Code Word—Bench Machine.....	Bencomb
Code Word—Complete with Base.....	Comcomb
Diameter Hole in Saw.....	1"

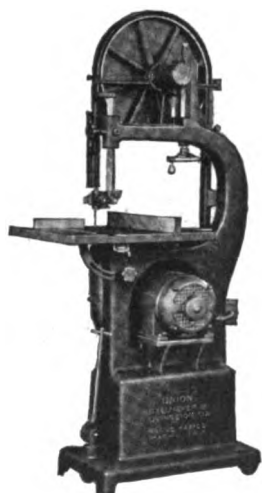
Twenty and Sixteen-Inch Band Saws

"Union" Portable Band Saws are superior in design, workmanship and material to most of the large 36 in. Band Saws on the market.

Both upper and lower wheels are accurately turned and balanced, rubber faced and equipped with the finest ball bearings. Aluminum guards protect both wheels and the saw as well. Nothing has been overlooked in making the "Union" safe for school use.

A repulsion induction type ball bearing motor is mounted directly on the lower wheel eliminating all gears and belts and guaranteeing that every ounce of power in the motor is transmitted directly to the saw. Motor is usually supplied to operate from lighting current but power line motor of either ½ h.p. or 1 h.p. can be supplied when so desired.

The table tilts to any angle up to 45 deg. and can be quickly locked at any setting. An iron rocker seat, bored in the main frame, with an iron rocker on the bottom of the table, provides a permanent, rigid mounting. The table of the 20-in. machine is slotted for a cross cut gauge and both cross cut and ripping gauges are supplied for this model if desired.



Specifications

	16-in.	20-in.
Diameter of Wheels.....	16 in.	20 in.
Size of Table.....	18 x 20 in.	22 x 25 in.
Size of Motor.....	½ h.p.	½ h.p.
Distance Inside of Frame to Saw.....	16 in.	20 in.
Maximum Height Under Guide.....	7¼ in.	10 in.
Length of Saw.....	9 ft. 2 in.	11 ft. 4 in.
Net Weight—Complete with Base.....	325 lbs.	600 lbs.
Net Weight—Bench Type with Motor.....	175 lbs.	Not Furnished

Single and Double Spindle Shapers

"Union" motor driven shapers can be furnished either single or double spindle.

Tables are carefully machined and fitted with removable rings. In the double spindle model the spindles are spaced 20 in. apart. The yokes are fitted with extra capacity ball bearings that are thoroughly protected for oil and against dirt, and are so made that the pulleys and spindles are covered in front. Yokes fit into dovetailed ways with adjustment for changing height as required. Spindles are made of high carbon steel accurately ground, provided with thrust bearings and tapped to receive the projecting part or for the use of special points and small cutters. Chucks to use router bits can be readily fitted. In the double spindle machine one spindle works right and the other left handed.

The motors regularly furnished are ¼ h.p. repulsion induction type with ball bearings, mounted vertical and belted direct to spindle. Power line motors from 1 to 3 h.p. can be furnished for heavy work. The double spindle model is supplied with stationary base only. Guards for knives are furnished as shown in the illustration.



Specifications

	Double Spindle	Single Spindle
Size of Table.....	30 x 48 in.	26 x 36 in.
Size of Spindle Extension.....	¾ x 4¾ in.	¾ x 4¾ in.
Speed of Spindle.....	8500 r.p.m.	8500 r.p.m.
Size of Motor.....	½, 1, or 2 h.p.	½, 1, or 2 h.p.
Net Weight.....	1200 lbs.	515 lbs.

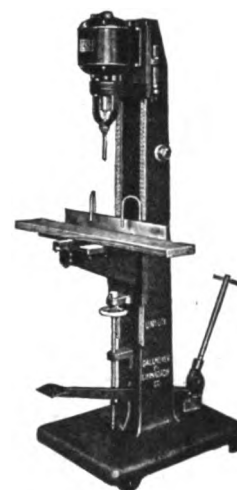
Vertical Boring Machine and Hollow Chisel Mortiser

These two high grade accurately made machines are identical in construction except that the mortiser is equipped with the hollow chisel holder.

The main frame has dovetailed ways accurately planed and scraped, on which the head is reciprocated in the boring or mortising work, and also ways on which the table is adjusted vertically.

The standard table has in and out movement of 4¾ in. by means of a screw feed. A hardwood top is mounted on the accurately machined table. A compound table for mounting upon the standard table is obtainable at slight extra cost. Provision is made for swinging of the standard table to 45 deg. either side of horizontal, and this may be done quickly and easily without disturbing the vertical adjustment which is accomplished by means of a vertical screw and handwheel.

Standard motor is ¼ h.p., equipped with radial and thrust ball bearings.



Specifications

Length of Table.....	33 in.
Vertical Travel of Chisel or Bit.....	3¾ in.
Vertical Adjustment of Table.....	17 in.
End of Mortiser Chisel to Table, Maximum.....	17 in.
Center of Chisel or Bits to Fence, Maximum.....	4¼ in.
Size of Hole in Spindle.....	¾ in.
Size of Hole for Chisel Shank.....	¾ in.
Size of Bushing for Chisel Bit.....	¾ in.
Speed of Boring Bit.....	3450 r.p.m.
Table Tilting Movement Either Way.....	45 deg.
Size of Standard Motor.....	¼ h.p.
Net Weight.....	425 lbs.

Gallmeyer & Livingston Company, 213 Straight Ave., Grand Rapids, Mich.

Hall & Brown Wood Working Machine Co.

1913-1933 N. Broadway, St. Louis, Mo.

Manufacturers of

Woodworking Machinery

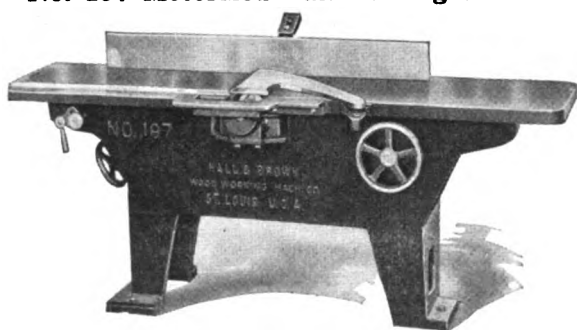
Jointers, Planers, Saw Machines, Lathes, Shapers

H. & B. products are well known to industry the world over. Through the vast experience gained in fifty years of manufacturing of quality wood-working machinery, we are able to place upon the market machines of unequalled design and construction. The school which selects its shop equipment from among the machines actually used in production work in modern factories goes a long way toward giving the student a right start. The machines listed here are a very small part of the H. & B. line. If you do not find the machines you need, write us for further information.



H. & B. machines are standardized in design and construction. All working parts are made by jigs and templet on the latest automatic machinery. This means absolute interchangeability of all vital parts. It insures perfect fit and correct engineering relations of parts; minimizes friction and saves power; and by enabling us to build larger numbers of machines of standardized, proven models, it cuts down the cost of manufacture and insures the buyer of better machines and better service at lower initial cost and lower cost of maintenance.

No. 197 Motorized Ball Bearing Jointer



No. 197 is adapted to a very wide range of work, such as planing stock out of wind, chamfering, beading, bevelling, rabbeting, mitring, etc. The heavy rigid frame consists of two inclines and base bolted to the heavy legs. Tables are raised and lowered by hand wheels.

The solid round safety type cylinder is accurately ground and dynamically balanced, and is equipped with three thin high speed steel knives.

No. 197 has an inbuilt motor mounted directly on the cylinder. It can also be had with the motor direct coupled or belt drive.

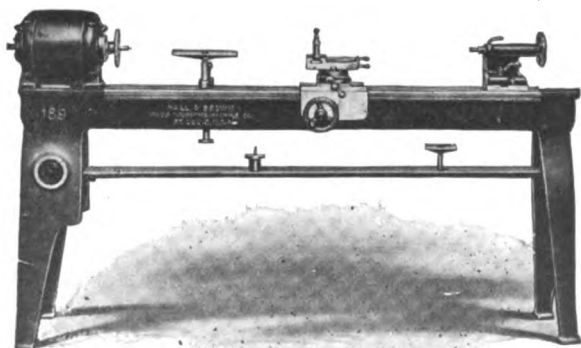
Equipment: Three high speed steel knives, aluminum guard and wrenches.

Specifications

	8-inch	12-inch	16-inch	20-inch
Length Overall.....	66"	84"	84"	84"
Size of Front Table.....	14x33 1/2"	18x44"	22x44"	26x44"
Size of Rear Table.....	14x30"	18x38 1/2"	22x38 1/2"	26x38 1/2"
Height of Machine.....	33"	33"	33"	33"
Cutting Circle of Head.....	4 1/2"	4 1/2"	4 1/2"	4 1/2"
R.P.M. of Cylinder Head.....	3600	3600	3600	3600
H.P. of Motor.....	2	3	3	5

No. 189 Motor Headstock Lathe

The first 12-inch lathe ever used in a manual training school was built by this company in 1885 and today the "H. & B." Company still sets the pace with their new No. 189 Motor Headstock Lathe with 1/2 H.P. four-speed ball bearing



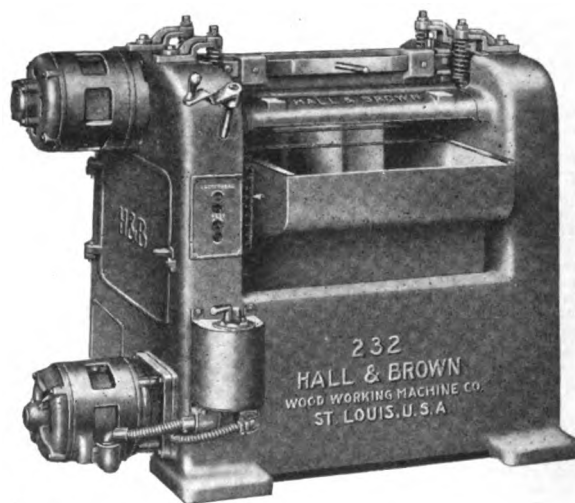
motor controlled by dial set in leg of the machine. It can be had in either Alternating or Direct Current. The bed regularly is furnished in two lengths, 4 ft. and 5 ft. for turning 24" and 36" respectively. An 8-ft. bed can be furnished and will turn 6 ft. between centers.

The tailstock is adjustable to any point and locked in position. Tool rest and rest holder are vertically adjustable to and from the work and to any angle. A hand feed carriage with a cross feed and compound rest can be furnished.

Equipment: One tail center, one face plate, two cone centers, one spur center, one rosette chuck, two rests, one socket and blue print holder.

No. 232 Motorized Ball Bearing Surfer

This ball bearing 24" Single Surfer is a 100% electrified. There is not a belt on the entire machine. The three knife round safety type cylinder has an inbuilt high speed motor mounted directly on its journal and a two speed



motor drives the feed. Centralized push button control starts and stops the motors. A drum controller produces two rates of feed 17' and 34' per minute. An electrical interlock makes it imperative to start the cylinder motor before the feed can be set in motion.

The cabinet type frame is rugged and massive in construction. It fully encloses all moving parts.

The four feed rolls are power driven. The top infeed roll is corrugated while the top out feed roll is smooth and equipped with a scraper. When narrow stock of varying thicknesses is to be surfaced a sectional infeed roll should be used.

Lubrication is provided by high pressure grease gun system.

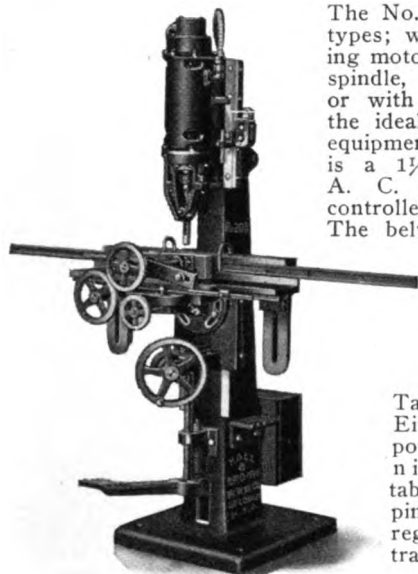
Specifications

Width will surface.....	24"
Table lowers.....	8"
Diameter of feed rolls.....	3 1/2"
Rates of feed.....	17' and 34'

Hall & Brown Wood Working Co., St. Louis, Mo.

Hall & Brown Wood Working Machine Co., Continued

No. 208 Motorized Hollow Chisel Mortiser



The No. 208 is built in three types; with inbuilt ball bearing motor mounted on the bit spindle, belted motor drive or with countershaft. It is the ideal machine for school equipment. Motor headstock is a 1½-H.P. 3600 R.P.M. A. C. ball bearing motor controlled by push buttons. The belted motor drive has any standard 1800 R. P. M. motor mounted on a bracket. Built-in blower cools the tools and disposes of chips.

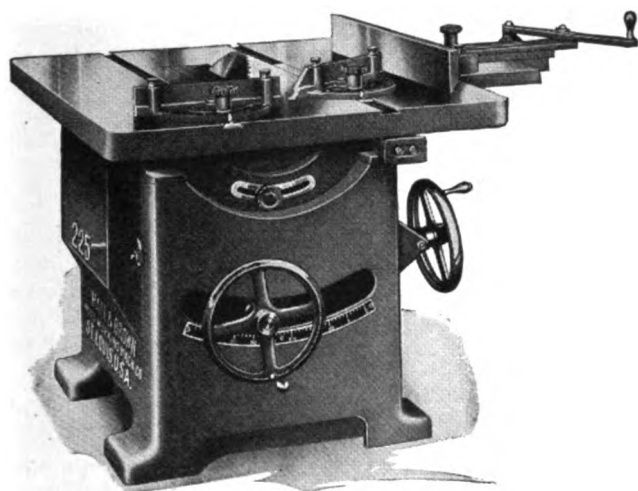
Takes chisels up to ¾". Either plain or compound table can be furnished. Compound table has rack and pinion feed. Stop rods regulate distance of travel.

Specifications

Length of Table.....	36"
Vertical Adjustment of Table.....	12"
Horizontal Adjustment of Table.....	16"
Maximum Opening under Chisel.....	12"
Maximum Stroke of Chisel.....	3½"
Maximum Size of Mortise.....	¾" sq.
Table Angles.....	45 deg.
Vertical Adjustment of Gauge.....	11"
Center of Chisel to Gauge, Maximum.....	3"

No. 225 Motorized Tilting Arbor Saw

No. 225 is adapted to a wide range of work, ripping, cross cutting, mitering, double mitering, dadoing, beveling, grooving, etc.



It has an inbuilt motor mounted directly on the saw arbor and the saw can be tilted to any angle up to 45°. With the standard plain or compound roller table it will rip 26" to the right and 18" to the left of saw. With 16" saw in vertical position it will cut 4" thick and when angled 45° will cut 2½" thick. Takes dado heads up to 4" wide. A 20" diameter saw can be used.

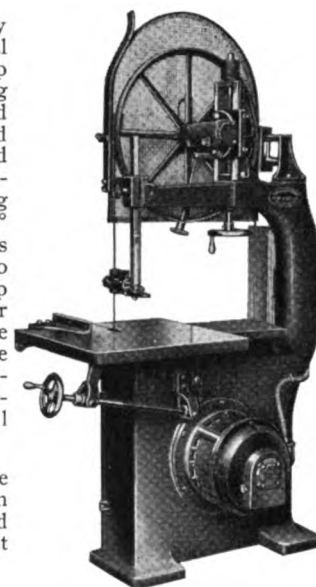
Specifications

Size of Plain or Compound Roller Table.....	38"x46"
Size of Roller Table only.....	18"x46"
Height of Table from Floor.....	34"
R.P.M. of Saw Arbor.....	3600
Size Hole in Saw.....	1¼"

No. 186 Electric Ball Bearing Band Saw

This machine will meet every requirement of the manual training school, pattern shop or any other woodworking industry. It is manufactured with an inbuilt motor mounted on lower wheel shaft, belted motor drive or with countershaft. The table is self locking and angles 45° forward and 15° backward. Antifriction guides are furnished. Blades up to 1½ inches can be used. Top wire mesh guard and lower enclosing doors protect the operator. Ball bearings are of the highest quality and revolve in an oil bath. A sensitive coil spring absorbs all tension of saw blade.

Equipment: Any size blade up to 1 inch. Antifriction guides, brazing clamp and tongs, ripping gauge, dust spout and wrenches.

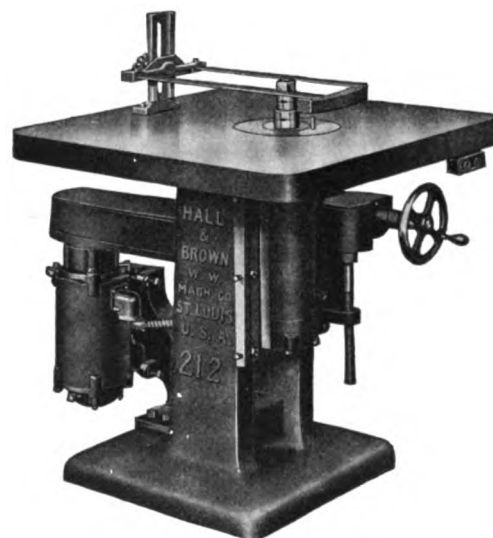


Specifications

	No. 185—30"	No. 186—36"
Diameter and Face of Wheels.....	30x1¾"	36x2"
Distance from Saw to Frame.....	30"	36"
Maximum Height under Guide.....	17"	19"
Size of Table.....	28½x30"	28½x30"
Size of Auxiliary Table.....	12x14"	14x19"
Height of Table from Floor.....	37"	41¼"
R.P.M. of Countershaft.....	600	600
Length of Saw Blade.....	17' 0"	19' 0"

No. 212 High Speed Ball Bearing Shaper

The No. 212 develops a 7200 R.P.M. spindle speed. It is manufactured with an inbuilt Ball Bearing Motor mounted directly on the spindle and also with a high speed ball bearing motor mounted on a bracket. Both types are con-



trolled by push buttons. The frame is a one-piece casting with a smoothly surfaced table. The spindle is heat-treated alloy steel and has a maximum projection of 7 in. above the table. Ball bearings are the deep groove precision type. These high speed motorized shapers can also be had with two spindles.

Specifications

Size of Table.....	34x36"
Height of Table from Floor.....	35½"
Diameter of Spindle above Table.....	1½"
Size of Spindle Pulley.....	3x7½"
Size of Motor Pulley.....	6x4"
R.P.M. motor mounted on bracket.....	3600
H.P.....	3 and 5

Hall & Brown Wood Working Machine Co., St. Louis, Mo.

C. O. Porter Machinery Co.

Grand Rapids, Mich.

Manufacturers of

"The Porter" Woodworking Machines

Back of this Coat of Arms is a carefully guarded policy to build, not the most machinery, but machinery that reaches the top of the yardstick of value.

"Porter" Wood Working Machines are liked because all major parts and each little detail are executed conscientiously. They are especially suited



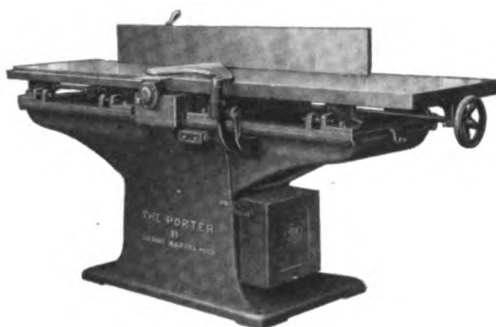
for school use because they are near fool-proof, well built, and have exceptional guarding.

This specialized equipment is made with unstinted care to advance the educational efficiency of any school in which it is used.

The "Porter" Coat of Arms IS the mark of real satisfaction.

Type "B" Hand Jointer

Applicable for edge jointing, beveling, planing out of wind, rabbeting and making special moldings. Heavy iron base and frame designed to give perfect support. Accurately ground tables adjusted by handwheel. Cutterhead has 5 in. cutting diameter, is made of a high carbon forging, accurately ground, and is regularly furnished with three knives. Ball bearings of generous size. Accurate gauges and efficient safety guards. Standard motor drive is for 50 or 60 cycles, two or three phase, 220, 440, or 550 volts with relay magnetic control.

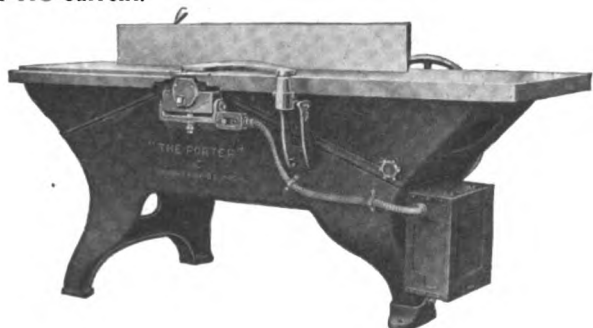


Specifications

	Motor Driven "B.M."
Width of cut.....	12" 16"
Extreme width of tables.....	15 1/4" 19 1/4"
H.P. recommended (or furnished).....	4 4
Vertical adjustment of tables.....	34" 34"
Speed of cylinder (approx.).....	3600 r.p.m. 3600 r.p.m.
Net weight of machine (approx.).....	1250 lbs. 1450 lbs.
Overall floor space required.....	88" x 34" 88" x 38"

No. 300 Type "C" 8-ft. Bed Hand Jointer

"The Porter" Type "C" 8-ft. Bed Hand Jointer is an ideal school machine because it features decidedly fool-proof characteristics, is very safe, free cutting, is furnished fully complete and is the highest development in the Jointer field. The machine is suitable for the same purposes as the type "B" machine, and is furnished with motor on arbor drive for AC current.

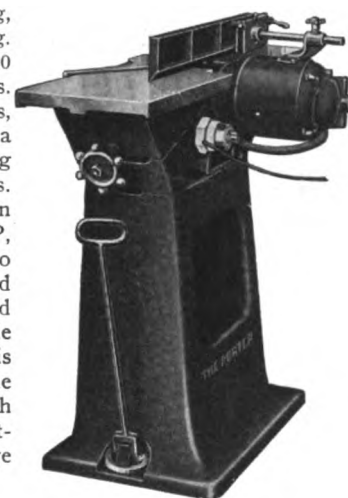


Specifications

Width of cut.....	12" 16"
Overall length of tables.....	96" 96"
Cutting diameter of cylinder.....	5" 5"
Horsepower furnished.....	4 4
Speed of cylinder.....	3600 r.p.m. 3600 r.p.m.
Net weight of machine.....	1600 lbs. 1850 lbs.
Floor space required.....	32" x 96" 36" x 96"

6 and 8-Inch Hand Jointers

For edge jointing facing, beveling and rabbeting. Cast iron column with 20 deg. planed incline ways. Smoothly ground tables, steel lipped. Cylinder is a three-knife, 4 1/4 in. cutting diameter with thin knives. Deep groove precision bearings. Motor is 1 HP, 3600 RPM, 60 cycle, two or three phase, mounted on the arbor and hand controlled; 1/2 HP, single phase, 110 volt motor is satisfactory for portable use. Cast iron base with or without wheels for portability. Accurate gauge and adequate guards.

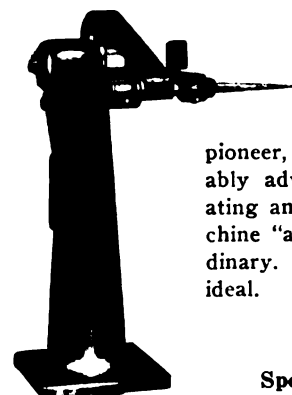


Specifications

	6-in.	8-in.
Length over all.....	40"	48"
Height from table to floor.....	32"	33"
Height from table to stand.....	9"	9"
Width of cut.....	6"	8"
Depth of cut.....	3/4"	3/4"
Width of tables.....	10 1/2"	12"
Weight of machine complete with motor and stand, net.....	425 lbs.	475 lbs.
Floor space required.....	6 sq. ft.	8 sq. ft.

No. 3 MB Spindle Carver

The mechanics of furniture are fundamental but art is undeniably important. The carver is used to execute beautiful decorations, and progressive vocational schools make it a point to advance the use of this machine.



The Porter Carver is the old pioneer, continuously modernized, noticeably advanced. Balanced, smooth operating and free-cutting, it enables the machine "artist" to skillfully do the extraordinary. For vocational purposes, it is ideal.

Specifications

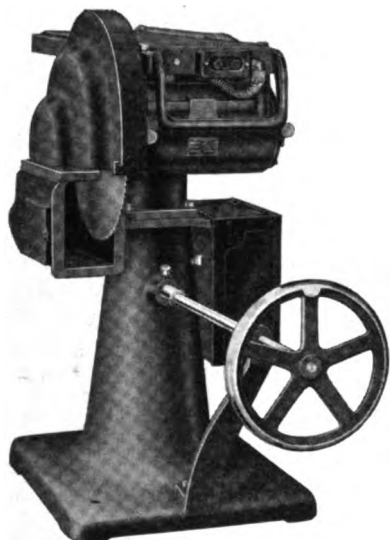
Height, spindle to base.....	46"
Diameter spindle between bearings.....	1-15-16"
Length of main spindle.....	24"
Spindle speed.....	10,000 RPM
HP furnished.....	1
Net weight, motor driven machine.....	600 lbs.

C. O. Porter Machinery Co., Grand Rapids, Mich.

C. O. Porter Machinery Co., Continued

Straight Line Saws

"The Porter" Straight Line Saws are the pioneers in the field. The Type A 43 machine is particularly suitable for schools as this machine is used for regular cutting off, may be used with dado heads, and may be swung so it will cut on an angle. The carriage is made of high grade aluminum and this operates on ball bearings running on hardened raceways. In addition to the standard machine, this saw is furnished to cut up to and including 36" in width. The machine is well guarded and comes fully complete with 18" blade, control and blow pipe connection.



Specifications

Height over all with carriage lowered.....	42"
Maximum elevation of carriage.....	8"
Width of cut.....	20"
Thickness of cut with 18" blade.....	5"
Horsepower of motor.....	4
Speed of arbor.....	3600 r.p.m.
Machine cuts to 45 degrees, will carry a 2 1/4" wide dado head	
Net weight of complete machine.....	670 lbs.

18-Inch Portable Band Saw

This small Band Saw is as carefully, accurately, and sturdily built as any larger machine. It is complete in every detail, and the full protection of the saw and other moving parts makes it admirable for the school shop. Takes up to 7 in. thick stock on straight or irregular cuts. Cast iron column and base designed for rigidity and convenience. Equipped with rollers for moving. Table accurately machined; tilts to 45 deg. Miter and ripping gauges accurately machined. Wheels faced with rubber; upper is aluminum web type for safety; lower is iron spoke type. Upper wheel adjustable for blade alignment and tension. Guides are Anti-Friction Wright type above table, and adjustable type below. 1/2 HP drives through belt.



Specifications

Height over all.....	72"
Floor space required.....	20 x 34"
Size of base.....	16 x 30"
Size of table.....	18 x 20"
Diameter of wheels.....	18"
Distance table to guide.....	7 1/4"
Length of blade.....	9' 8"
Net weight of machine.....	500 lbs.

The Porter No. 103 Motor Driven Shaper

The No. 103 Shaper is fine for school work because it is strictly a small production machine, built with as much pride as the large Porter Shaper.

It is furnished with a two horse power motor giving a splendid range of work, plenty big enough for educational purposes. The spindle revolves at 10,000 RPM and has a detachable top, this feature permitting the use of various cutting combinations. The machine is equipped with knife and filing collars, a knife guard and hold-down, also magnetic push button control for the motor. The point is stressed that this is an unusual small shaper.



Specifications

	Single	Double.
Height floor to table top.....	37 1/4"	37 1/4"
Size of table.....	38" x 24"	48" x 28"
Diameter spindle top, standard.....	3/4"	3/4"
Length of spindle at collars above shoulder.....	4"	4"
Approximate r.p.m. of spindle on 60 cycle.....	10,000	10,000
Approximate r.p.m. of spindle on 25 cycle.....	7,000	7,000
Distance between centers (regular).....	20"	20"
Floor space required.....	38" x 35"	48" x 36"
Approximate net weight.....	575 lbs.	1100 lbs.

No. 402 Single Surface Planer

A machine, designed and built as carefully as any cabinet machine. No. 402 will produce clean cut work at a surprising rate. Distance of only 2 1/2 in. between pressure bar and chipbreaker makes it almost impossible to gouge out the tail end of stock at the same time assuming an even smooth surface. All moving parts are enclosed—a safety feature important to schools. Motors have low voltage protection and are independently protected from overload. Magnetic push button control.



Specifications

	Motor Driven	Belt Driven
Width of cut.....	24 1/4"	24 1/4"
Thickness of cut.....	8"	8"
Number of knives in cylinder.....	3	3
Size of knives.....	1 1/4 x 3/4"	1 1/4 x 3/4"
Speed of cylinder.....	3600 r.p.m. (sync.)	4000
H.P. furnished and recommended.....	5 1/2	5
Net weight of machine.....	1700 lbs.	1850 lbs.
Floor space required.....	40 x 54"	40 x 54"
		(Mach. only)

C. O. Porter Machinery Co., Grand Rapids, Mich.

Adjustable Clamp Company

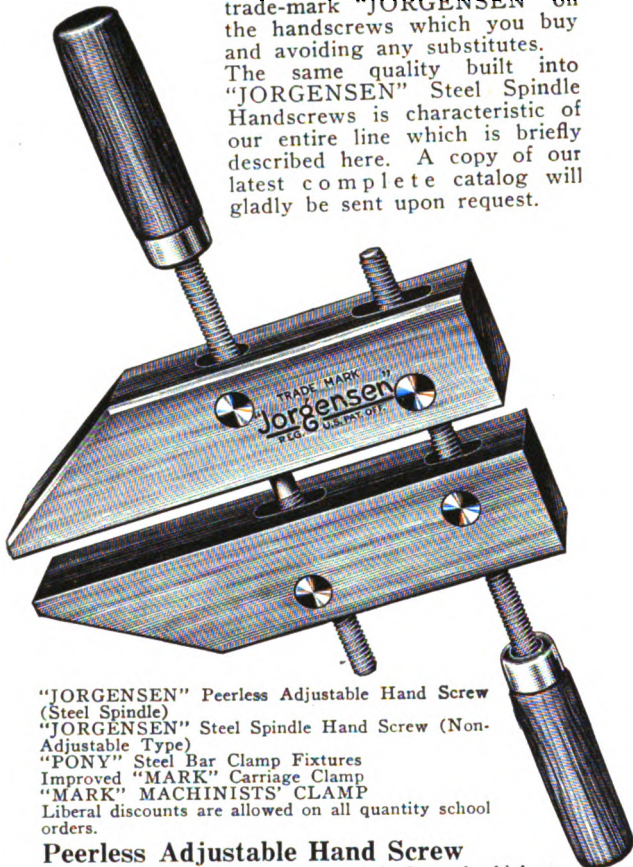
424 N. Ashland Ave., Chicago, Ill.

Manufacturers of

Handscrews and Clamps

TRADE MARK
"Jorgensen"
REG. U.S. PAT. OFF.

Steel Spindle Handscrews, made exclusively by us for twenty-five years, have proven so much more serviceable and economical than any other tools of the kind that they have practically displaced every other kind of handscrews made previously, and no worth-while improvements have been developed since. We suggest the advisability of looking for our registered trade-mark "JORGENSEN" on the handscrews which you buy and avoiding any substitutes. The same quality built into "JORGENSEN" Steel Spindle Handscrews is characteristic of our entire line which is briefly described here. A copy of our latest complete catalog will gladly be sent upon request.

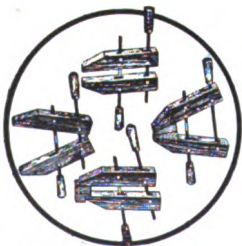


"JORGENSEN" Peerless Adjustable Hand Screw (Steel Spindle)
"JORGENSEN" Steel Spindle Hand Screw (Non-Adjustable Type)
"PONY" Steel Bar Clamp Fixtures
Improved "MARK" Carriage Clamp
"MARK" MACHINISTS' CLAMP
Liberal discounts are allowed on all quantity school orders.

Peerless Adjustable Hand Screw

"JORGENSEN" Handscrews are made from the highest quality maple, selected for perfect grain after proper seasoning, and seasoned again after being cut into rough sizes. This stock is then accurately worked up and finished in oil. The steel used is of special analysis, with accurately cut threads of a type which long service has proven exceptionally strong and durable and particularly adapted to this purpose. Genuine "JORGENSEN" Handscrews hold tightly and stay tight on the work. The threads will not strip or break, and glue will not adhere to them. They work much faster than wood screws. The handles are put on true and will not come loose. These handscrews are made entirely in our own factory, assembled and tested before shipment, and cannot be taken apart. They are shipped in sealed corrugated fiber cartons.

In the "JORGENSEN" Peerless Adjustable Type, the jaws have a swivel action within convenient limits, which makes the bearings self-aligning, avoiding any tendency to bind or bend the spindles, and permitting adjustment to conform to any angular position in order to distribute pressure evenly on the work. This adjustment also permits the jaws to be offset endwise, which is often desirable.



TRADE MARK
"Jorgensen"
REG. U.S. PAT. OFF.

PEERLESS ADJUSTABLE HAND-SCREWS will adjust to any of the positions shown, or any modification of them.

Specifications

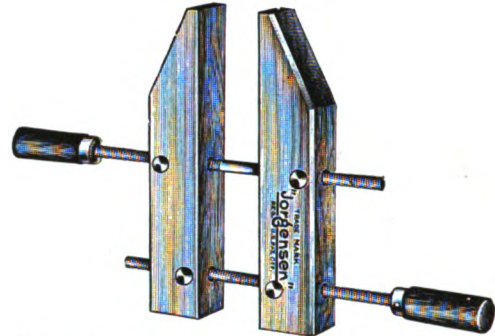
No.	Length of Jaws	Max. Opening Between Jaws
5/0	4"	2"
4/0	5"	2 1/2"
3/0	6"	3"
2/0	7"	3 1/2"
0	8"	4 1/2"
1	10"	6"
2	12"	8 1/2"
3	14"	10"
4	16"	12"
5	18"	14"
6	20"	14"
7	24"	17"



TRADE MARK
"Jorgensen"
REG. U.S. PAT. OFF.

Non-Adjustable Hand Screw

The "JORGENSEN" Steel Spindle Hand Screw of the Non-Adjustable Type is

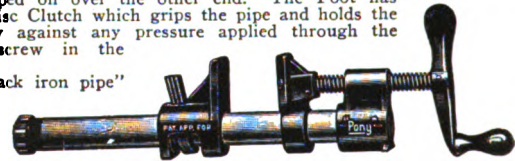


made of the same materials and design, and in the same sizes as the Peerless Adjustable, with the exception that the nuts and spindles are not permitted to swivel in the jaws, thus holding the jaws parallel at all times.

"PONY" Steel Bar Clamp Fixtures

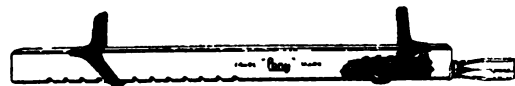
"PONY" Steel Bar Clamp Fixtures make up clamps on any length of 3/4 in. black iron pipe without the use of tools. No holes nor notches are cut in the pipe. The head of the clamp is screwed on to the regular pipe thread at one end of the pipe, and the foot, or tail-piece, is slipped on over the other end. The Foot has a Multiple Disc Clutch which grips the pipe and holds the Foot securely against any pressure applied through the crank and screw in the head.

Ordinary "black iron pipe"



makes a clamp strong enough for any light or medium-heavy work, but if a stiffer clamp is found necessary, use extra-heavy 1 in. pipe. These Clamps are remarkably quick in action. The Foot is moved against the work instantly, where it locks automatically. No time is lost to set this part at any certain hole or notch, nor is any time required to run the screw in or out to fit the work.

"Pony" Wood Bar Combination Cabinet Clamp "Dana" Pattern



A light weight wood bar clamp for cabinet or other work where heavier clamps might injure the finish. All parts are of best selected material, carefully made and assembled. Malleable iron jaws have leather buffers. Tail piece engages notches in the bar quickly and securely, and is held in place by a heavy flat spring riveted to the jaw. The screw is of cold drawn steel with heavy square threads. The handle bears against a heavy reinforcing washer to prevent splitting of the bar. Bar is 1 1/2 x 2 in., of perfect grain hard maple, oil finish. All parts are interchangeable. Six sizes: 18, 28, 38, 48, 60, and 72 in. between jaws.

"MARK" Carriage Clamp

These clamps are correctly designed, liberal in weight, and carefully made of the best malleable iron, which their design has distributed to give the greatest strength and rigidity. Large diameter screws of cold drawn steel with extra deep cut threads, insuring long wear and extra large wings at the end are features. All sizes are ordinarily furnished with ball and socket swivel tip, but plain riveted swivels can be supplied.



Specifications

Cat. No.	Opens Inches	Depth Throat	Cat. No.	Opens Inches	Depth Throat
102	2 1/2 in.	1 1/4 in.	107	7 in.	3 1/4 in.
103	3 in.	2 1/4 in.	108	8 in.	3 3/4 in.
104	4 in.	2 3/4 in.	110	10 in.	4 1/4 in.
105	5 in.	2 3/4 in.	112	12 in.	4 3/4 in.
106	6 in.	2 3/4 in.			

Adjustable Clamp Company, 424 N. Ashland Ave., Chicago, Ill.

E. C. Atkins Company

Home Office and Factory
402 So. Illinois St., Indianapolis, Ind.

Machine Knife Factory:
Lancaster, N. Y.

Cantol Belt Wax Factory:
Bloomington, Ind.

Canadian Factory:
Hamilton, Ont.

Atlanta
Chicago
Memphis

Paris, France

BRANCH HOUSES
New Orleans
New York

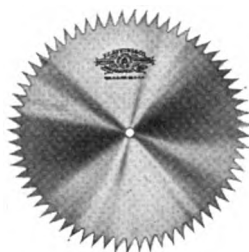
Vancouver, B. C.

Portland
San Francisco
Seattle

Manufacturers of

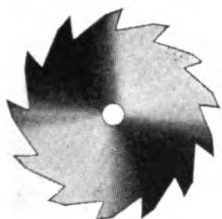
All Kinds of Saws, Saw Tools and Saw Specialties

Atkins Solid Tooth Circular Saws



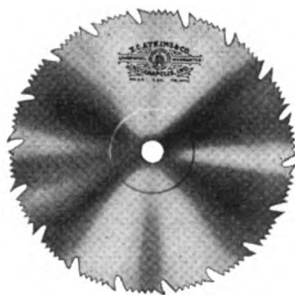
Atkins Solid Tooth Circular Saws are made of Atkins SILVER STEEL an exclusive formula that holds its edge better and cuts faster. Both rip and cutoff of all styles and pitches of teeth. Send for Mill Saw catalog.

Atkins Grooving Saws



Grooving Saws made regular or with spiral or special shapes of teeth to suit requirements. Diameters 4 to 16 inches; thickness $\frac{1}{8}$ to $\frac{3}{4}$ inches; tooth space $\frac{1}{2}$ to 2 inches. These saws are fast cutting and are very accurate because they are hollow ground. They will cut either with or across the grain as well as mitre.

Atkins Dado Head and Mitre Saws



Atkins Dado Heads (SILVER STEEL). Outside cutters are $\frac{1}{8}$ inch thick; inside cutters $\frac{1}{4}$ to $\frac{1}{2}$ inch thick and in sets cut a groove $\frac{1}{8}$ to 4 inches wide; wider if necessary. Diameters 6 to 20 inches. Atkins Combination or Mitre Saws (hollow ground) for smooth accurate cutting; with standard pattern of teeth for the work.

Atkins Narrow Band Saws



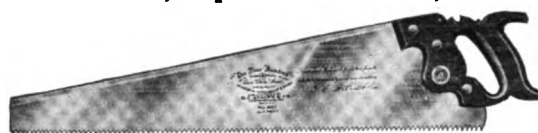
Atkins Narrow Band Saws (SILVER STEEL). Various widths from $\frac{1}{8}$ to $1\frac{3}{4}$ inches and from 23 to 20 gauge. 3 to 8 points per inch. They can be furnished cut and brazed in proper lengths ready for use or in coils of 250 feet. (Also made for cutting Metal.)

Atkins Machine Knives



Atkins makes "A PERFECT MACHINE KNIFE FOR EVERY PURPOSE" of the finest knife steel. We will gladly furnish you template paper for any of your requirements and tell you how to care for them. Send for complete Knife Catalog.

Atkins Hand, Rip and Panel Saw, No. 401



"The 401" SILVER STEEL straight back Hand Saw is a companion saw to "The 400"; 5 gauges taper ground; Mirror polish; solid rosewood Improved Perfection Handle, prevents wrist strain. Wide or narrow pattern, straight or skew back. Made 20 to 26 inches; $4\frac{1}{2}$ to 11 points, hand, rip and panel.

Atkins Hand, Rip and Panel Saw, No. 53



No. 53 is made of genuine SILVER STEEL taper ground. Given the ATKINS Exclusive Damaskeen Finish. Skew back and fitted with the ATKINS PERFECTION HANDLE, made of applewood, embossed and polished. Made in both regular and ship patterns. Lengths 16 to 28 inches. $3\frac{1}{2}$ to 11 points per inch.

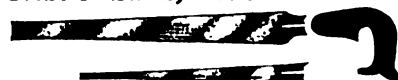
Atkins Back Saw, No. 2



Atkins No. 2 Back Saws are of SILVER STEEL, applewood handle; 2 brass screws and medallion. Lengths 8 to 18 inches. Blued Steel back.

Atkins Nest of Saws, No. 3

No. 3 Nest of Saws consists of 12" Key-hole Blade, 14" Compass Blade and 16" Metal Cutting Blade; all SILVER STEEL.



Three angle adjustable handle of selected hardwood. Easy grip.

Atkins Silver Steel Files



Atkins makes from their celebrated SILVER STEEL every kind of File in all the standard sizes except Files for jewelers. Send for file chart of file recommendations and various kinds of Atkins Files.

E. C. Atkins & Company, 402 So. Illinois St. Indianapolis, Ind.

Batavia Clamp Co., Inc.

Established 1881 — Incorporated 1923

Batavia, N. Y.

Manufacturers of Colt's Clamps

For 49 years COLT'S CLAMPS have been STANDARD for all artisans in the various trades wherever clamps are used.

The rapidity of application of the Eccentric Clamp has an appeal as a TIME SAVER.

Our steel bars are rolled "Special" for our

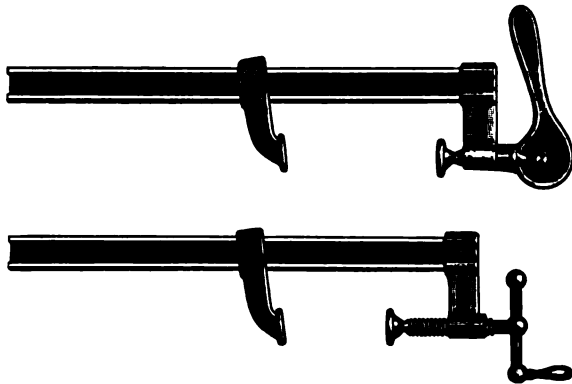
COLT'S
BATAVIA, N.Y.

use and the fittings are of the best quality of refined malleable iron.

New styles have been added and improvements made from time to time to meet the demand of our patrons and keep our line of Colt's Clamps up to a high mark of perfection.

Colt's CABINET Clamp

Eccentric or Screw



I shaped steel bar $1\frac{1}{4}" \times \frac{1}{8}"$.

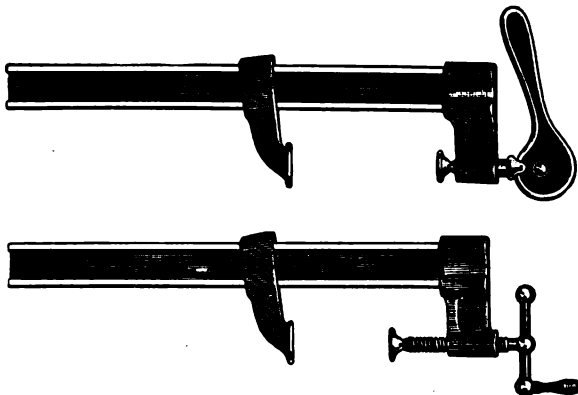
Adjustable foot locking at any place on the bar when pressure is made with the quick acting cam or a short turn of the screw.

2" Reach from bar to center of pressure. Sizes 12, 18, 24, 30, 36, 48, 60, 72, 84, and 96 inch.

Also made with **4" Reach**. Sizes 6, 8, 10, 12, 18, and 24-inch.

Colt's EXTRA HEAVY Clamp

Eccentric or Screw



I shaped steel bar $1\frac{1}{8}" \times \frac{3}{4}"$.

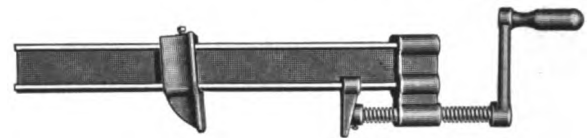
2" Reach for heavy work.

Sizes 12" to 96" (or longer on special order).

4" Reach for work where pressure is required 4" from the edge. Sizes 12" to 96".

6" Reach for work where pressure is required 6" from the edge. Sizes 12" to 96".

Colt's VISE Clamp



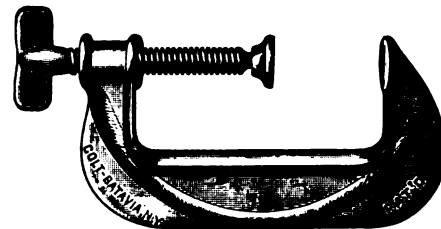
Steel I bar $1\frac{1}{8}" \times \frac{3}{4}" - \frac{1}{4}"$ steel screw.

For wide thin work.

Clamping surfaces 2" square. Sizes 12" to 96".

Size indicates the number of inches of work the clamp will take in, and **Reach** the distance from the bar to center of pressure. The wide range of specifications of the above line of quick adjustable clamps cover a large field of trade requirements.

Colt's "C" Clamp

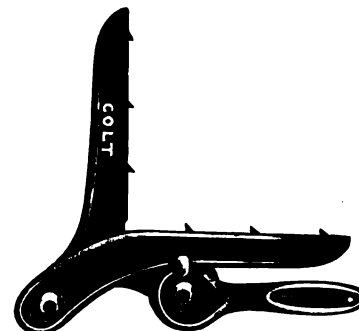


A heavy malleable iron screw clamp with Colt's Reinforcing Ribs (a truss rod moulded in the body); large wings, oversize screw and acme threads. A quality tool for heavy duty. Ball and socket button.

Sizes 2 3 4 6 8 10 12 inch

Reach $1\frac{3}{4}$ $2\frac{1}{8}$ $2\frac{1}{2}$ $2\frac{7}{8}$ $3\frac{1}{8}$ $3\frac{3}{4}$ $4\frac{1}{4}$ inch

Colt's MITRE Clamp



One motion of the cam sets the mitre, positive in action, no springs to get out of order.

Catalog No. 342 showing our complete line will be sent on request.

Batavia Clamp Company, Batavia, N. Y.

E. C. Atkins & Company

Home Office and Factory
402 So. Illinois St., Indianapolis, Ind.

Machine Knife Factory:
Lancaster, N. Y.

Atlanta
Chicago
Memphis

Cantol Belt Wax Factory:

Bloomington, Ind.

BRANCH HOUSES
New Orleans
New York

Paris, France

Vancouver, B. C.

Canadian Factory:
Hamilton, Ont.

Portland
San Francisco
Seattle

Manufacturers of

All Kinds of Saws, Saw Tools and Saw Specialties

Atkins Grinding Wheels



Acrolite Grinding Wheels are pure Crystalline Alumina—almost as pure as the Ruby or Sapphire and next in hardness to Diamonds. It is adapted for grinding materials of high tensile strength such as: Saws, Knives, Woodworking Tools, Milling Cutters, Reamers, Shear Blades, Planer and Lathe Tools, etc. Ferrolite for hard Malleable Iron, Brass, Copper, Cements, Rubber, etc. Send for Grinding Wheel catalog.



Atkins Text Book for Instructors

The finest Text Book ever written for Instructors on the care of Hand, Rip and Panel Saws is published by E. C. Atkins and Company. It contains illustrated instructions in the form of lessons on the correct and incorrect method of filing and setting Hand, and Small Saws.

Write us for your copy—free of charge.



Atkins Cantol Belt Wax in Bars

Cantol Belt Wax one-pound bars is preferred where belt slip must be stopped quickly without using rosin or other injurious material. It does not melt under 217° Fahr., so it is not affected by heat. It is purposely made hard. A little goes a long way.



Atkins Cantol Belt Wax (Liquid)

This Liquid is packed in one gallon cans and is especially recommended for conditions where a great amount of dust collects on the belts, as in woodworking shops, machine shops and print shops.

Atkins Saw Sense for Students



For the woodshop student Atkins "Saw Sense" illustrates and describes the various kinds of saws used in the modern shop. There are many schools profiting by the students learning from the "Saw Sense" book how to file and set their own saws, saving the school many dollars and the instructors hours of time. Illustrated instructions on the correct methods of fitting are included, showing how they should be when in good working condition.

Atkins Perfection Scraper

Patented Cam Blade adjustment. Sand blasted, maple handle, varnished and polished. 12 inches over all. Blade of SILVER STEEL, beveled edges 2 1/8 x 2 1/8 inches. Holds its edge a long time. Makes scraping easier.



Atkins Cabinet Scrapers



Cabinet Scrapers made of Atkins SILVER STEEL in 18, 19 or 20 gauge with finished edges. Various sizes as follows:

Length	Inches 5, 5, 5, 6, 6, 6, 6
Width	Inches 2 1/4, 3, 3 1/4, 2 1/4, 3, 3 1/4, 4

The French pattern shown on right is made of SILVER STEEL with hand finished edges.

2 1/4 x 5 inches	18, 19 or 20 gauge
3 x 5 inches	18, 19 or 20 gauge
2 1/4 x 6 inches	18, 19 or 20 gauge
3 x 6 inches	18, 19 or 20 gauge

Atkins No. 20 Catalog

To those who have charge of requisitioning and purchasing of saws, saw tools and saw specialties we respectfully call their attention to Atkins New No. 20 catalog of 256 pages showing our complete line of Wood Saws, Hack Saw Frames and Blades, Perforating, Cutting and Scoring Rules, Paper Knives for the Print Shop. If you need a copy for reference write us on your school letterhead—free for the asking.



E. C. Atkins & Company, 402 So. Illinois St., Indianapolis, Ind.

Behr-Manning Corporation

Troy, N. Y.

Branch Offices: Boston, Buffalo, Chicago, Cincinnati, Cleveland, Detroit, Grand Rapids, High Point, Indianapolis, New York, Philadelphia, St. Louis, San Francisco, Tacoma, Toronto

Quality Coated Abrasives

The work of vocational education, having as its object the training of youth to take an efficient part in the fast moving industries of today, is faced with the necessity of constantly keeping abreast of the progress made in the development and improvement of industrial tools and appliances. In no other field, is progress more apparent than in the development of coated abrasives. Not so long ago, sandpaper was just sandpaper, and bought as such. Today, sandpaper is a true production cutting tool, just as much as any planer or milling machine, and is purchased on the basis of what it will do. The application of the proper abrasive, to produce a maximum efficiency, is a problem your graduates will have to meet, and we shall be glad to help you in teaching that proper application.



For Woodworking

Flint Paper

For general purpose hand sanding on soft woods, Behr-Manning Flint Paper is a standard abrasive. Coated

with finest flint quartz, it is made in 9"x11" sheets (Brooklyn-Troy brand) and 8 3/4"x10 1/2" sheets (Empire-Mohawk brand). These sheets are packed in standard quire and half ream bundles, but for shop use, the box method of packing is strongly recommended.

The strong boxes provide a neat, convenient storage place, and prevent the scattering of sheets all over the shop.

Grit numbers available are:

Brooklyn-Troy—4/0 to 3 1/2.

Empire-Mohawk—3/0 to 3, inclusive.



For Metal Working

Balanced Metalite Cloth



For metal sanding, the electric furnace abrasive, Metalite, has taken the place of natural Emery where it is necessary to remove stock. Its higher production and longer life recommend it as the most economical metal

sanding abrasive. Metalite Cloth is provided in squarely cut, 9"x11" sheets—either Regular or Flexible—wrapped in quire (24 sheets) packages, and quarter ream bundles.

Grit numbers—320, 240, 180, 150, 120, 100, 80, 60, 50, 40, 36, 24.

Metalite Cloth Handy Rolls

Metalite Cloth is also available in Handy Roll form. In tearing a strip from a Handy Roll, the workman obtains just the right length of material, with straight, sharp edges. Available in 50 yard rolls, 1", 1 1/2", and 2" wide, in all regular grit numbers.



Emery Cloth

For metal polishing, where no appreciable amount of stock must be removed, Emery Cloth, coated with finest Turkish emery grain, may be used. This material is supplied in 9"x11" sheets.

Grit numbers—3/0, 2/0, 0, 1/2, 1, 1 1/2, 2, 2 1/2, 3, 3 1/2.

For Water Sanding Paints, Varnishes, Lacquers, Enamels, and Surfacer

Behr-Manning Waterproof Silicon Carbide

The distinctly improved water sanding paper—Behr-Manning Waterproof Silicon Carbide—is the result of recent developments in manufacturing methods, producing a sheet that is faster cutting, finer finishing, more flexible, and longer lasting than any heretofore available. The application of any waterproof sandpaper is a technical problem, and we shall be glad to supply detailed information on any class of work. Weights of backing are A-light, C-medium heavy, and D-heavy.

Grit numbers—400-A, 320-A or C, 280-A or C, 240-A or C, 220-A or C, 180-C, 150-D, 120-D.



Garnet Paper

Behr-Manning Ream Garnet Paper, also known as Cabinet Paper, is made to meet the requirements of hand work on wood. For this purpose, the ideal abrasive is Adirondack Garnet, and in Behr-Manning Cabinet Paper, this perfect natural abrasive is coated, in the finer numbers, on a 70-lb. paper, the weight increasing as the grit numbers increase in coarseness. Thus, a balanced sheet, fitting the job, is assured.

Grit numbers—4/0 to 2.

Behr-Manning Garnet Finishing Paper is a specialized product for very fine wood finishing. It is possible, in fine cabinet work, to use this paper with oil, for oil rubbing varnish. Made on a light 40-lb. Manila rope paper backing, with a light, flexible coating, the whole sheet will stand bending without cracking or peeling.

Grit numbers—7/0 to 0.

Behr-Manning Roll Garnet Paper meets the severe requirements of machine sanding on drum, spindle, belt, and disc machines. The 130-lb. Manila rope paper backing has a high tensile strength, high fiber adhesion, and the finished product is free from wavy edges and buckles, assuring straight belts and flat drum covers. The coating is so balanced as to give sharp, free cutting action, without loss of grain on hard work. Available in 50 yard rolls, in widths up to 24", in grit numbers from 6/0 to 3 1/2; in widths up to 36", in grit numbers from 3/0 to 3; and in widths up to 48", in grit numbers from 2/0 to 3.

Adalox-Durundum Paper

Behr-Manning Adalox-Durundum Paper is designed for very severe woodworking operations requiring a tougher abrasive than natural Garnet. It is particularly suited to the sanding of extremely hard woods, and to repair work in which a possibility of striking nails is present. The grain is the same electric furnace abrasive that makes Metalite Cloth such an ideal metal sanding abrasive.



Adalox-Durundum Paper, in the lighter weight backings, A or C, is used extensively for the final finish, sanding of metal fillers and surfacers, where its hardness and toughness give a higher cutting capacity and speed on production work.

For metal clean-up, preparatory to finishing, Adalox-Durundum Paper E weight is sometimes used in place of Metalite Cloth, where the work does not call for the strength or flexibility of a cloth backing. Available in 9"x11" sheets, in grits from 320-9/0 to 24-3, and in 50 yard rolls, up to 24" wide, in grits from 120-3/0 to 24-3.

Behr-Manning Corporation, Troy, N. Y.

The R. L. Carter Company

Phoenix, N. Y.

Manufacturers of

Routers and Hand Shapers

The Carter Motor

The basic part of all Carter Machines is the Carter motor. These motors, being made in sizes varying from 1/7 H.P. to 3/8 H.P., cover practically the entire field of portable uses, and together with scores of fixed applications make possible innumerable different operations. All Carter Machines are guaranteed against defective material and workmanship. All repairs should be made at our factory.

Brief specifications of Carter Motors are as follows:

Type	Horse Power (rated)	(actual)	R.P.M.	Weight
R7 and S7	1/7	1/7	18,000	3 lbs.
R4 and S4	3/8	3/8	18,000	5 lbs.
R5	1/2	1/2	14,500	15 lbs.
R2 and S2	3/4	3	15,800	35 lbs.

Motors operate on A.C. or D.C. Specify whether 110 or 220 Volts.

CARTER PRODUCTS



Type R7 Router

Electric Routers

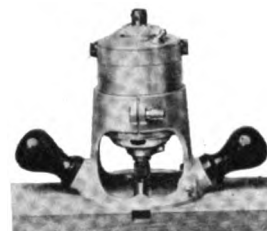
1/4 H.P. Electric Router (Type R7)

The Carter Type R7 Router consists of the Type R7 Motor equipped with template guide. The motor, being threaded into the base, permits accurate adjustment to depth. Each complete turn of the motor in its base equals 1/16". Chuck takes 1/4" shank bits only. Templet guides screwed to end of motor and do not revolve. Will do veining and all kinds of line work, routing for line and block inlay, paneling, panel and bracket moulding, veneer patching, light fluting on flat and cylindrical surfaces, beading and fluting spindles, hand carver's routing, routing in soft metals, etc.

1/4 H.P. Electric Router (Type R4)

Has greater capacity for the same work Type R7 performs and does many additional jobs. Comes equipped with Router Base, Templet Guide and Straight and Circular Guide (See illustration below). Takes bits up to 3/4" with 1/4" shank. Same general design as R7. Weight complete only 5 lbs., but develops 3/4 actual H.P.

Cutting Block Inlays and Routing is done with either R7 or R4 by using a Recess and Insert Guide. Guide has a removable collar with a wall thickness the same as the bit used. With collar ON recess is cut. With collar OFF the inlay is cut.



Type R4 Router

Hand Shapers

1/4 H.P. Hand Shaper (Type S7)

The Carter Type S7 Hand Shaper consists of the Type S7 Motor equipped with the guide collar for straight work as illustrated at the left. Taking any one of the variety of specially made Carter tools, it will do all corner cuts such as beads, chamfers, rounds and coves after the work is assembled. Its speed of 18,000 R.P.M. assures smooth work. In combination with the attachments described here, and others, it will do countless jobs no other machine can touch.



S7 Hand Shaper with Guide Collar

The S7 Compound Curve Guide (See illustration for S4 below) fits over the end of the motor enabling the shaper to follow practically any edge or surface—something no other shaper will do. Particularly adapted for cutting surface beads, grooves or rabbets where edges or surfaces are irregular. Maximum distance of cut from edge of work, 1".

The S7 Shaper Holder permits perfect edge beading and grooving on any piece where the edge alone is irregular regardless of the size of the work.

1/4 H.P. Hand Shaper (Type S4)

For heavier work requiring two hands. Will do all kinds of rounding, beading, chamfering, and special shaping such as required on table and desk tops, legs and posts and many special operations. The S4 Hand Shaper is regularly equipped with Cone and Guide Collar as shown at the right.



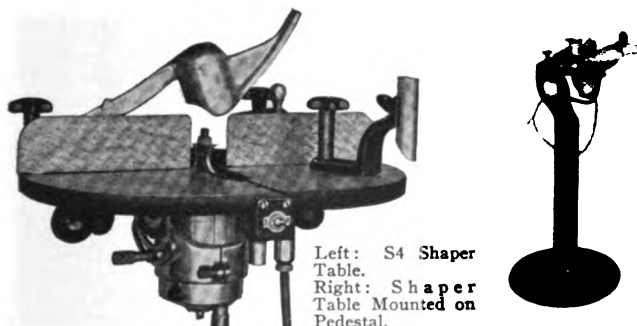
S4 Hand Shaper with Cone and Guide



S4 Compound Curve Guide

The S4 Compound Curve Guide shown at the left eliminates practically all hand work on irregular surfaces. Guide is fully adjustable to any shape surface.

The S4 Shaper Table shown below converts the Hand Shaper into a complete Universal Shaper. Motor tilts 45° either way and has vertical and horizontal adjustment. Adjustable back fence, circular guide, and automatic safety guard, 2" jointer knife supplied.



Left: S4 Shaper Table.
Right: Shaper Table Mounted on Pedestal.

Cutters and Grinding Wheels

Cutters and Grinding Wheels for use with the S7 and S4 Hand Shapers are specially made of the finest materials but not high priced (50 cents to \$4.00). They come in a great variety of shapes and sizes as pictured and described in Folder D.



Veining on Irregular Surfaces

table and chair legs, etc. With the cutter turning 18,000 R.P.M. absolutely smooth work is certain.

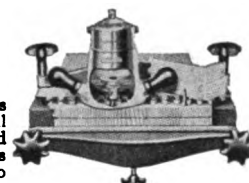
The Adjustable Straight and Circular Gauge shown below fits either R7 or R4 and is regularly furnished with R4. Gauge and stop rods are 7" long. Gauge reversible to follow straight or curved edges. For any routing that must be parallel with edge of work.



R7 Shown Using Circular End of Straight and Circular Gauge



Beading Spindle with Beading and Fluting Attachment



Dovetail Attachment with R4 Router in Position

The Dovetail Attachment at the right fits only the R4 Router. Using a dovetail templet, as shown, both pieces (front and side) of joint are completed in one pass across the work. Attachment clamps to bench. Takes pieces up to 13" in width, any thickness.

The Shaper Table described in the opposite column also fits Type R motors to form a combination bench or portable universal shaper. Send for Folder C.

Other Carter Applications

In the Pattern Shop the making of small core boxes is greatly simplified through the use of the Type R7 or R4 Router with the half round cutter shown in folder C. Saw out a templet on the Band Saw, run the Router around it, repeat the operation with the templet reversed for the other side of the core box and a two hour job is completed in a few minutes.

The Door Set comprising a 1/4 H.P. Router, Adjustable Hinge Butt Templet, and Lock Mortiser Attachment should be part of the equipment for every class in carpentry. Folder A describes it in detail.

The R. L. Carter Company, Phoenix, N. Y.

The Cincinnati Tool Company

4037 Main Ave., Cincinnati, Ohio

Manufacturers of

Clamps and Other High Grade Mechanic's Tools

Since 1879 HARGRAVE CLAMPS have played an obscure but important part in American industrial development. Few tools indeed can boast a record as impressive. Fifty years ago HARGRAVE CLAMPS were designed and constructed to be the finest clamps on the market. Since then a steady process of refine-

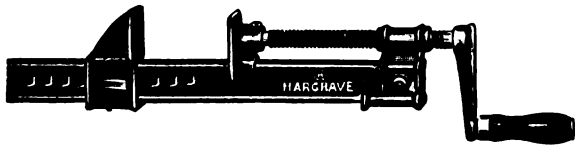


ment and improvement has increased their supremacy until today they are universally recognized by both craftsmen and production engineers as without rival.

The Cincinnati Line of Hargrave Clamps is complete and includes improved designs of every clamp used in woodworking or machine shop.

Improved "I" Bar Clamp

(Patented)



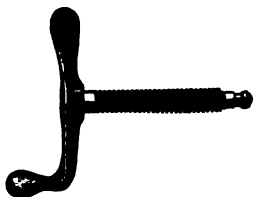
It is very powerful, having "I" shape high carbon steel bar $1\frac{1}{2} \times \frac{3}{4} \times \frac{1}{8}$ in. The screw is steel, $\frac{5}{8}$ in. diameter, with deep cut Acme thread and extra long bearing, giving great power and insuring long life to the Clamp. The tip has case hardened thrust bearing for the end of screw which practically eliminates wear. Crank, frame, tip and slide are of the best grade of malleable. Slide has tempered steel dog for engaging the notches, making it absolutely positive. Will not slip or stick. The notches do not weaken the bar as there is no metal removed and they are in the web.

Being spaced only $\frac{1}{2}$ in. apart, they permit rapid adjustment.

Furnished with All Metal "T" Crank Handle if desired. Available in the following sizes:

Opening—feet 2, $2\frac{1}{2}$, 3, $3\frac{1}{2}$, 4, $4\frac{1}{2}$, 5, 6.

(We manufacture both lighter and heavier Steel Bar Clamps and will be glad to send you catalog showing our complete line.)



This All Metal "T" Crank Handle can be furnished upon our Steel Bar Clamps or Clamp Fixtures, instead of the regular Cranks if preferred. However, regular Cranks as illustrated will be furnished unless the "T" Handle is specified.

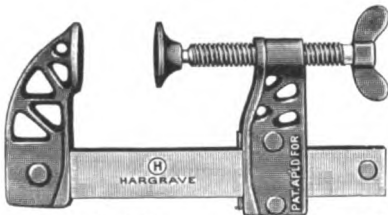
Quick Clamps (Patented)

Excellent general purpose clamps. Can be instantly applied or removed from the work; handier to operate, take up less room and save a great amount of time over ordinary clamps. Especially useful in pattern making, boat and ship building, and in automobile body and airplane work.

Rigid at any opening, thus overcoming the weakness of the long and easily bent screw of the old "C" Clamp. Will not slip or release when jarred.

The bar is high carbon manganese steel, rolled from our special analysis. Frame and foot are of the best grade of malleable. Their construction prevents side twist and enables the clamp to stand tremendous strain.

Furnished in any size opening and in any depth from 2" to 9".



The Standard Clamp

(Trade Name Registered)



Carriage

The Hargrave Standard Carriage Clamp is particularly favored by large manufacturers because of its superior strength and design. The frame is made of the best grade malleable iron, heavily reinforced and so shaped as to give

greatest strength for the metal used. The large diameter steel screw will not bend or break.

Furnished either with button tip or with oscillating tip.

Opening—inches $2\frac{1}{2}$ 3 4 5 6 7 8 10 12

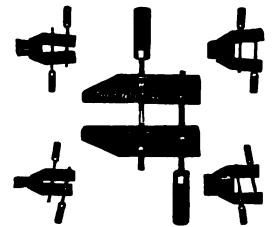
Depth—inches $1\frac{3}{4}$ $1\frac{7}{8}$ $2\frac{1}{8}$ $2\frac{1}{2}$ $2\frac{3}{4}$ 3 $3\frac{1}{4}$ $3\frac{3}{8}$ $3\frac{5}{8}$

(We manufacture both lighter and heavier pattern "C" Clamps and will be glad to furnish catalog showing our complete line.)

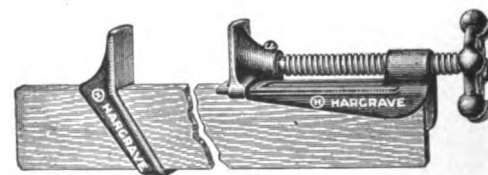
Steel Spindle Hand Screws

These Hand Screws have proven very popular in the schools. They are strong, durable and satisfactory. The jaws are selected hard maple. Spindles and bearings are steel. Spindles have deep cut Acme thread insuring long life to the bearings. Handles are fluted, giving good grip. Workmanship and materials are strictly first class, insuring long and satisfactory service. Made in both Adjustable and Non-Adjustable Patterns, in the following standard sizes:

Length of jaws	6	8	10	12	14	16	18
Opening	3	$4\frac{1}{2}$	6	$8\frac{1}{2}$	10	12	14



Clamp Fixtures



This illustration shows our No. 615 which fits $1\frac{1}{8} \times 2\frac{1}{4}$ in. bar. Made of malleable iron parts and steel screw. All Metal "T" Crank Handle furnished if desired.

Our No. 614 Clamp Fixture is somewhat heavier and fits 2×4 in. bar or smaller. It is furnished with regular crank with wood grip or with All Metal "T" Handle if preferred.

Catalog showing our complete line of Clamps, Chisels, Punches, Saw Vises and other tools being used extensively by Manual Training Schools will be mailed to you upon request.

The Cincinnati Tool Company, 4037 Main Ave., Cincinnati, Ohio

Clarke Sanding Machine Company

3815 W. Cortland St., Chicago, Ill.

Manufacturers of

The Clarke Vacuum Portable Sander

A COMPLETE Sanding Equipment IN ONE UNIT

The Clarke is the universal sander. It will do roughing work and fine finishing work, from a deep planing cut to a satin-smooth Cabinet finish. It combines the operations of the big stationary three-drum sander, the belt sander, the arm sander and the floor sander in one light-weight compact machine. And it does the work

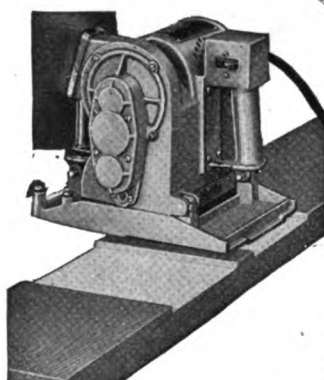
of these machines more conveniently, cleanly, quickly and economically, without the complicated and time-wasting changes and adjustments that are unavoidable in such machines.

In addition the Clarke does work that the bigger machines cannot do, such as finishing assembled pieces; and it can be easily used on the bench to finish small pieces of almost any size and width.

Performing All Operations from a heavy roughing cut to the finest satin-smooth finish.



The Clarke Portable Sander weighs only 22 lbs. Any boy can operate it on bench or floor. It produces a superior satin smooth finish.



The Clarke can take a heavy duty roughing or planing cut $\frac{1}{4}$ inch deep, across a 6 inch plank, in less than 20 seconds.



With base removed the Clarke forms and sands curved work. Performs many operations not possible on other sanders.

The Leading Sander

Outstanding ability has given the Clarke undisputed leadership in the sanding industry; has enabled it to supersede heavy awkward machines for sanding, planing, surfacing and finishing, in cabinet making and woodworking shops everywhere. This same outstanding ability and versatility commends the Clarke to manual training departments for teaching up-to-date wood-finishing methods.

Ideal for School Shops

The Clarke is the ideal machine for manual training shop use. It has its own in-built vacuum; and operates from any light socket. It requires no permanent floor space, no special blower system, no installation cost. It is years ahead of the field. No other



With base upturned it operates as a jointer for cutting down and smoothing small pieces.

sander meets your needs so completely. It is reasonable in price, representing but a fractional part of the cost of more expensive equipment which it is ably replacing in thousands of shops throughout the country.

Details of Construction

Only precision workmanship and materials of the highest quality enter into the manufacture of the Clarke. All parts are standardized and interchangeable and all working parts are enclosed insuring safe operation.

The HOUSING (which is one complete unit) the gear case, housing plates, drum plates, fan, switch handle, gear case cover, bag adapter, drum and base are all machined from aluminum castings of special alloy, with steel inserts at all points of wear.

The BASE is of patented construction, enabling the machine to work any width of surface, permitting perfect overlapping of each cut.

The DEPTH OF CUT can be instantly adjusted to the smallest fraction of an inch—an important feature in fine finishing.

The CLARKE MOTOR is universal, operating from either direct current, or alternating current 25 to 60 cycles, single phase. It is the most powerful motor of its size in commercial use. The Clarke motor has 1 H.P., yet it consumes approximately only as much current as the average $\frac{1}{2}$ H.P. motor. This motor gives the Clarke its fast cutting capacity that enables it to perform quantity and quality work heretofore done by big heavy machines equipped with two and three horse power motors running at low speed. Because 110 voltage is in common use, a 110 volt motor is always furnished unless otherwise specified. Cooling is effectively accomplished by forced suction of air through the motor by the fan which creates the vacuum for carrying all the dust into the dust bag.

Pays for Itself

Many schools have found that the Clarke more than pays for itself in the saving it brings when used outside class hours or during week-ends by the maintenance department in re-surfacing desks, tables, furniture and floors. A Clarke re-surfaces 120 to 200 desk tops or 900 to 3,000 square feet of average school floors per 8 hour day without gumming or clogging the sandpaper. For floorwork there is a special handle and floor bag that are easily attached, making the machine almost as easy to operate as a vacuum cleaner. The vacuum takes up all the dust and dirt so that varnishing can follow immediately after.



Guarantee

The Clarke is the only sander with a definite, positive written guarantee of performance. Include this guarantee in your specifications.

When Ordering, Specify:

THE CLARKE VACUUM PORTABLE SANDER, with built-in vacuum for collecting dust, complete with 1 Dust Bag and Adapter for quick attachment to machine; one 4-inch Lenox Screw Driver; 22 sheets assorted sandpaper; one 1-lb. can of Non-Fluid Oil for lubricating; 10 feet of Tyrex Rubber Covered Cord and Armoured Attachment Plug; 110 volts.

Weight 22 lbs. Price \$229.00 F.O.B. Chicago.

Floor Handle of grey iron casting with seamless steel tubing hand grip, complete with rollers; special Dust Bag for floor work.

Price complete \$9.00 F.O.B. Chicago.

Write direct to the Clarke Sanding Machine Company for additional information, illustrated literature, and Special School Requisition Blank.

Clarke Sanding Machine Co., 3815 W. Cortland St., Chicago, Ill.

The Columbian Vise & Mfg. Co.

Cleveland, Ohio

Manufacturers of

COLUMBIAN VISES

AND CLAMPS

THE Columbian Vise and Manufacturing Company produces the most complete line of vises put out by any one manufacturer. On this page are shown a few of the large assortment of Columbian Vises. Others are shown in Columbian Catalog, No. 291-B. Send for it.

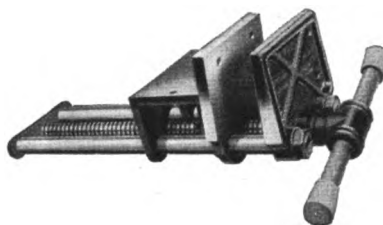
The Columbian line of Vises is standard in schools and in industry—wherever rugged dependability is demanded. Columbian Vises are available through your local hardware jobbers and mill supply houses. Send today for the Columbian Complete Line Catalog. Ask for No. 291-B.

Stationary Base Machinist's Vises



Vise No.	Width Jaw Inches	Jaws Open Inches	Weight Pounds Approx.
502	2	3	9
502½	2½	3½	13
503	3	4½	20
503½	3½	5	27
504	4	6	34
504½	4½	7	44
505	5	8	53
505½	5½	9	74
506	6	10	90
507	7	12	118
508	8	13	150

Continuous Screw Woodworker's Vises



Vise No.	Width Jaw Inches	Jaws Open Inches	Weight Pounds Approx.
Plain Front Jaw			
50C	4 x 7	9	22
13A	4 x 10	12	30
With Dog in Front Jaw			
50CD	4 x 7	9	23
13AD	4 x 10	12	31

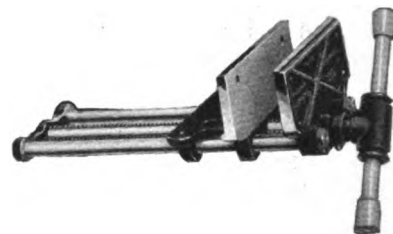
Swivel Base Machinist's Vises

Vise No.	Width Jaw Inches	Jaws Open Inches	Weight Pounds Approx.
602	2	3	10
602½	2½	3½	15
603	3	4½	25
603½	3½	5	32
604	4	6	39
604½	4½	7	55
605	5	8	61
605½	5½	9	84
606	6	10	100
607	7	12	135
608	8	13	160

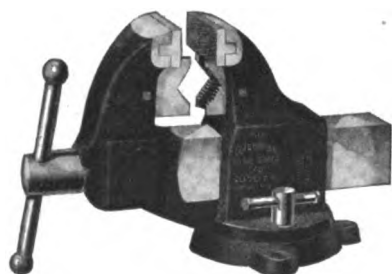


Rapid Acting Woodworker's Vises

Vise No.	Size Jaw Inches	Jaws Open Inches	Weight Pounds Approx.
Plain Front Jaw			
1C	4 x 7	9	24
9B	4 x 10	12	32
With Dog in Front Jaw			
1CD	4 x 7	9	25
9BD	4 x 10	12	33

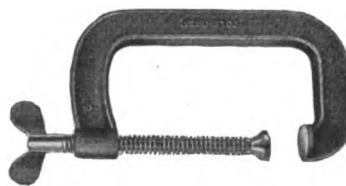


Combination Pipe Vises, Swivel Base



Vise No.	Width Jaw Inches	Jaws Open Inches	Holds Pipe Inches	Weight Pounds Approx.
203½	3½	4	½ to 2½	35
204½	4½	5	½ to 3½	58
205	5	6	½ to 4½	90
206	6	10	½ to 6	152

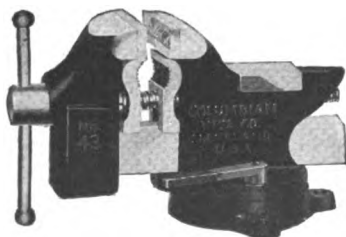
Drop Forged Steel Clamps



No.	Capacity Inches Max.	Min.	Center of Screw to Back Inches	Approx. Weight Pounds
13	3	0	2¾	1¼
14	4	0	2¾	2
15	5	0	3¾	2½
16	6	¾	3¾	3
18	8	2	4¾	4¼
20	10	4	5¾	6½

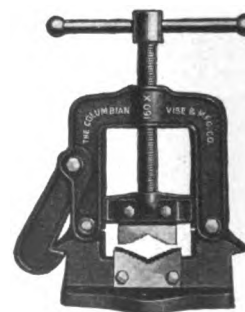
Handy Mechanic's Vise

Vise No.	Width Jaw Inches	Jaws Open Inches	Weight Pounds Approx.
43	3"	3½	14
43½	3½"	4	17
44	4"	4½	28



Hinged Pipe Vises

Vise No.	Holds Pipe Inches	Weight Pounds Approx.
16X	½ to 1½	5½
160X	½ to 2	8
161X	½ to 2½	11
162X	½ to 3½	17
163X	½ to 4½	26
Heavy Duty		
164X	½ to 6	40
165X	1 to 8	81
166X	1½ to 12	163



The Columbian Vise & Mfg. Co., Cleveland, Ohio

J. A. Fay and Egan Company

Cincinnati, Ohio, U. S. A.

Branches in all the principal cities of the world

Woodworking Machinery

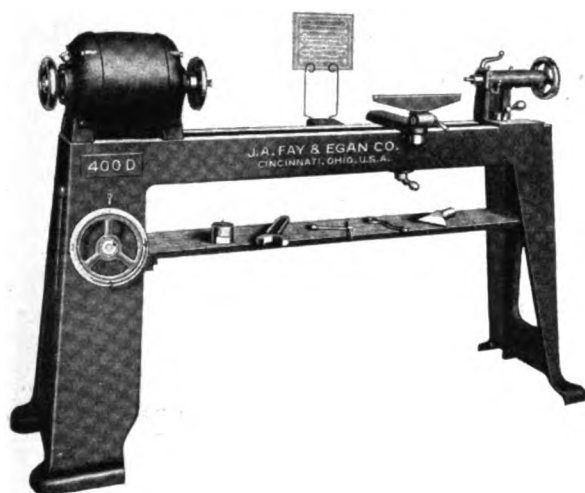
In making your selection of woodworking tools for instructing students, you should select tools that are used by all the leading manufacturers in the woodworking industry. By doing so you can train the students on production tools that are used in the shops as well as the schoolrooms. You thus increase the efficiency of the boys as they are capable of operating the same machines in the shops as they did in the class rooms.



The J. A. Fay & Egan Co. are the oldest and largest manufacturers of woodworking machinery in the world. With a slogan of "Woodworking Machinery With a Responsibility" each and every machine goes out carrying with it an iron clad guarantee that it must give satisfaction. Send for a copy of "Keeping Good Company." It will prove to you the outstanding choice of equipment for all the modern class rooms.

No. 400 Manual Training Lathe

The "400" series represent the last work in a multispeed Motor Headstock Lathe—Can be operated by the most inexperienced or careless student without injury to lathe or himself—control is built in "Safety Sealed."

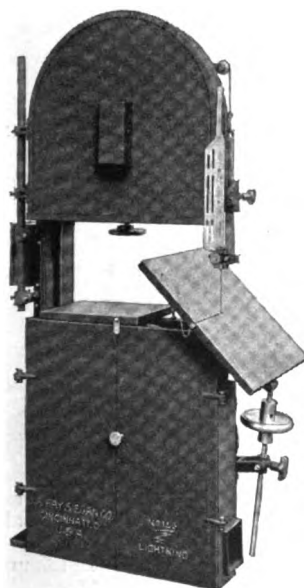


Specifications

12" Swing—4 foot bed—greatest distance between centers 24". Speed of Motor Headstock ranges from 450 to 3,450.

Motor ½ H.P. Push Button Control. On special orders any length of bed can be furnished.

No. 155 Band Scroll Saw



The Band Saw being one of the most used machines in the school, is always selected with great care. The sensitive straining device on the "155" is one of the many features that makes it so popular and stamps it the outstanding Band Saw for the class room.

Specifications

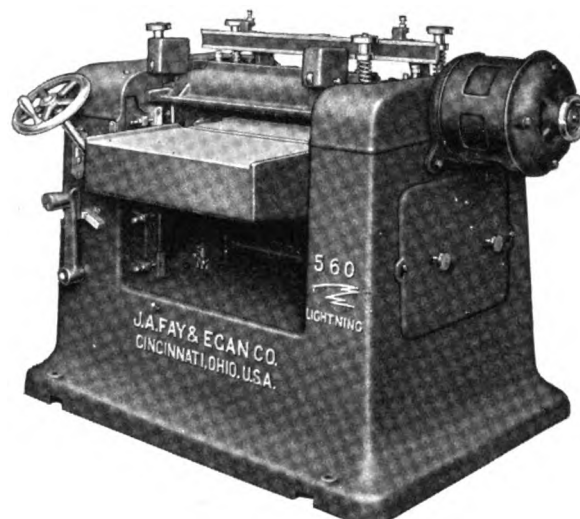
Wheels 30" in diameter. Takes 12" under the guide and 29" between saw and column.

Table is 26"x24" and angles 45° to the right.

Will be furnished with either 600 or 900 R.P.M. motor direct on lower wheelshaft.

No. 560—All Electric Surfacers

This new type construction with all revolving parts enclosed in the "Safety Sealed" column is the ideal surfer for the class room.



Specifications

Works stock up to 24" wide, 8" thick. Three Knife Cylinder—Four driven Feed Rolls. Two Speeds of Feed, 18 and 30 feet a minute. 5 H.P. motor built direct on cylinder.

No. 575—All Electric—Double Arbor Saw

The application of this all electric unit is almost unlimited. Ripping, Cross Cutting, Cutting Off, Mitering, Beveling, etc.—work requiring extreme accuracy is accomplished with flashing speed. The revolving plate which carries both a rip and cross cut blade is operated with utmost ease.



Specifications

Two 14" Saws regular—16" may be used. Two Section Table, one-half travels. Rips stock up to 26" wide, 3" thick—will cut off and edge material 35". Table opens up to permit 2" Dado Head—5 H.P. motor built in for each saw—guard and a selection of fences (extra).

J. A. Fay and Egan Company, (Oakley), Cincinnati, O.

Alfred Field & Company, Inc.

93 Chambers Street, New York

Importers of

Carving Tools, Chisels and Other Hand Tools

Wm. Marples & Sons, Ltd.

Sheffield

"Shamrock" Brand Tools

Wm. Marples famous chisels and woodworking tools for carpentry, cabinetmaking, patternmaking and woodturning are internationally known for their perfection of design and for the fine quality of Sheffield steel used in their manufacture. They have been called "the finest tools in the world." Every tool is guaranteed against defects and any tool showing defects will be replaced without charge. Look for the famous "SHAMROCK" trade mark stamped on every tool.

Patternmaker's Tools

Available in the following widths: $\frac{1}{8}$, $\frac{1}{4}$, $\frac{3}{8}$, $\frac{1}{2}$, $\frac{5}{8}$, $\frac{3}{4}$, $\frac{7}{8}$, 1, $1\frac{1}{4}$, $1\frac{1}{2}$ inches, with straight or Bent Shank. Chisels may be had with or without bevel; Paring Gouges with Full Sweep, Middle Sweep, Flat Sweep or Extra Flat Sweep. Complete with dog wood handles.



No. 100



No. 105

No. 100 shown above; No. 105 below.
No. 100. Long Paring Chisel, Beveled.
No. 101. Bent Shank Paring Chisel, Beveled.
No. 102. Long Paring Chisel.
No. 103. Bent Shank Paring Chisel.
No. 104. Long Paring Gouge.
No. 105. Bent Shank Paring Gouge.

Carpenter's and Cabinetmaker's Tools

Available in the following widths: $\frac{1}{8}$, $\frac{1}{4}$, $\frac{3}{8}$, $\frac{1}{2}$, $\frac{5}{8}$, $\frac{3}{4}$, $\frac{7}{8}$, 1, $1\frac{1}{4}$, $1\frac{1}{2}$ inches. Nos. 119, 121, 127 and 128 also come in $1\frac{3}{4}$ and 2-inch widths. Chisels with or without Bevel. Handles are Leather Topped on Chisels, all wood on Gouges.



No. 119



No. 124

No. 119. Beveled Firmer Chisel, $5\frac{1}{2}$ " long to bolster.
No. 120. Firmer Chisel, $5\frac{1}{2}$ " long to Bolster.
No. 121. Beveled Butt Chisel, $2\frac{1}{2}$ " Blade.
No. 122. Butt Chisel, $2\frac{1}{2}$ " Blade.
No. 123. Firmer Gouge, Outside Ground.
No. 124. Firmer Gouge, Inside Ground.
No. 125. Socket Beveled, Firmer Chisel, $5\frac{1}{2}$ " Blade.
No. 126. Socket Firmer Chisel, $5\frac{1}{2}$ " Blade.
No. 127. Socket Beveled, Butt Chisel, $3\frac{1}{4}$ " Blade.
No. 128. Socket Butt Chisel, $3\frac{1}{4}$ " Blade.
No. 129. Socket Firmer Gouge, Outside Ground, $5\frac{1}{2}$ " Blade.

Woodturning Tools

Woodturning Tools are available in widths of $\frac{1}{8}$, $\frac{1}{4}$, $\frac{3}{8}$, $\frac{1}{2}$, $\frac{5}{8}$, $\frac{3}{4}$, $\frac{7}{8}$, 1, $1\frac{1}{4}$ and $1\frac{1}{2}$ inches. No. 106 comes also in $1\frac{3}{4}$ and 2-inch widths. No handles furnished unless specified.



No. 106

No. 106. Turning Gouge.
No. 108. Turning Gouge, Long and Strong.
No. 109. Turning Chisel.
No. 111. Turning Chisel, Long and Strong.



Square No. 112 Round No. 113 Diamond No. 114 Right Skew No. 115 Left Skew No. 116
No. 117. Parting Tool— $\frac{1}{2}$, $\frac{3}{4}$, and $\frac{1}{2}$ inch.

Henry Taylor, Ltd.

Sheffield

"Acorn" Brand Carving Tools

The world's most famous carving tools are those made by Henry Taylor in Sheffield, England, and stamped "ACORN" Brand. Made of the finest Sheffield steel and designed exclusively for woodcarving, patternmaking, and Manual Training School use. Every "ACORN" Brand tool is guaranteed against defects and any tool showing defects will be replaced without charge.

Sizes and Sweeps of Straight and Bent Chisels, Gouges and Parting Tools

Sizes for each sweep run as follows: $\frac{1}{8}$ ", $\frac{3}{8}$ ", $\frac{1}{2}$ ", $\frac{5}{8}$ ", $\frac{3}{4}$ ", $\frac{7}{8}$ " and 1". Below are shown the 12 sweeps, each of which is available in twelve sizes and several styles.



Straight Gouges—Nos. 3, 4, 5, 6, 7, 8, 9, 10 and 11.



Bent Gouges—Nos. 12, 13, 14, 15, 16, 17, 18, 19 and 20.



Spoon Gouges—Nos. 24, 25, 26, 27, 28, 29, 30, 31 and 32.



Back Bent Gouges—Nos. 33, 34, 35, 36, 37 and 38.

Sweep	Straight Gouges Nos.	Bent Gouges Nos.	Spoon-bit Gouges Nos.	Back Bent Gouges Nos.	Straight V Tool Nos.	Curved V Tool Nos.	Spoon-bit V Tool Nos.
1	3	12	24	33			
2	4	13	25	34	39	40	43
3	5	14	26	35	41	42	44
4	6	15	27	36	45	46	
5	7	16	28	37			
6	8	17	29	38			
7	9	18	30				
8	10	19	31				
9	11	20	32				

In addition to the above, there are the No. 1 Straight Chisels, No. 2 Skew Chisels, No. 21 Spoon Chisels, No. 22 Spoon Chisels—Right Skew and No. 23 Spoon Chisels—Left Skew in all of the 12 sizes.

Carving Sets

These sets are put up in attractive brown canvas wrap rolls. All tools complete with handles.

Set No. 1—6 tools as follows: Nos. 1, $\frac{3}{8}$ "; No. 3, $\frac{1}{2}$ "; No. 5, $\frac{3}{4}$ "; No. 6, $\frac{3}{8}$ "; No. 8, $\frac{1}{4}$ "; No. 39, $\frac{3}{4}$ ".
Set No. 2—9 tools including the 6 listed above, and in addition No. 1, $\frac{1}{4}$ "; No. 7, $\frac{1}{2}$ "; No. 10, $\frac{1}{8}$ ".
Set No. 3—12 tools including the 9 listed above, and in addition, No. 4, $\frac{3}{8}$ "; No. 9, $\frac{3}{8}$ "; No. 45, $\frac{1}{2}$ ".

Linoleum Block Carving Tools



This Set No. 4 is designed especially for the purpose. Complete with graver type handles. 5 tools as shown here.



WRITE FOR CATALOGS.

No. 1 Tools for Pattern, Cabinetmakers and Woodturners.
No. 2 Carving Tools, all types with chart showing all sweeps.

No. 3 Carving Tool Sets in canvas rolls and Linoleum Block cutting tools.

Alfred Field & Company, Inc., 93 Chambers St., New York

Huther Bros. Saw Mfg. Co., Inc.

1190 University Ave., Rochester, N. Y.

Manufacturers of

Mechanical Saws for Metal and Cutting

Huther Bros. Saws are the result of more than sixty years' successful and uninterrupted experience in the manufacturing of saws. Each saw embodies the highest type



of workmanship and is backed by a guarantee to be free from flaws and seams as possible.



Huther Bros. Metal Cutting Band Saws

Huther Bros. Metal Cutting Band Saws

Flexible back type to allow bending over wheels. Hone hardened on the edge, these saws are furnished in two tempers—one for steel, iron, etc., and another for softer metals, such as brass or aluminum.

When ordering, specify materials to be cut and size—also whether material is sheet, bars or tubes.

Furnished from $\frac{3}{8}$ to $1\frac{1}{2}$ inch wide. Teeth from 8 to 24 points per inch.



Huther Bros. Patented Dado Head

Huther Bros. Patented Dado Head

For cutting any width groove from $\frac{1}{8}$ to 4 inches or more. The regular heads consist of two outside cutters, each $\frac{1}{8}$ inch thick, which can be used singly to cut grooves $\frac{1}{8}$ inch or together to cut $\frac{1}{4}$ inch. The two inside cutters must be used between the two outside saws to make wider grooves.

Sets are arranged as follows:

- No. 1 Set—Cuts $\frac{1}{8}$ to $\frac{3}{8}$ by $\frac{1}{8}$ inch.
- No. 2 Set—Cuts $\frac{1}{8}$ to $\frac{3}{8}$ by $\frac{1}{8}$ inch.
- No. 3 Set—Cuts $\frac{1}{8}$ to $\frac{3}{4}$ by $\frac{1}{8}$ inch.
- No. 4 Set—Cuts $\frac{1}{8}$ to 1 by $\frac{1}{8}$ inch.
- No. 5 Set—Cuts $\frac{1}{8}$ to $1\frac{1}{2}$ by $\frac{1}{8}$ inch.
- No. 6 Set—Cuts $\frac{1}{8}$ to 2 by $\frac{1}{8}$ inch.
- No. 7 Set—Cuts $\frac{1}{8}$ to 3 inches wide.
- No. 8 Set—Cuts $\frac{1}{8}$ to 4 inches wide.

*Special sets made to cut from 4 to 8 inches wide.

When ordering, specify width of cut desired. Instructions for filing and fitting are furnished with each set. Specify size hole.



Huther Bros. High Speed Steel Knives

Huther Bros. High Speed Steel Knives

These are made of best quality high speed steel, properly tempered. Particular attention is paid to the balance of these knives. Specifications should give distance on cutting edge, distance from front to back, and thickness desired. Also, when more than one set is ordered, number of knives to a set should be specified in order that they can be balanced accordingly.

Huther Bros. Smooth-Cutting Saws

These saws are ground on sides for clearance. Have no set-on teeth and make a smooth cut. We are prepared to furnish a variety of teeth, as shown in cut. However the No. 1 tooth cuts equally well with or across the grain and is the saw most generally used. Specifications should include size hole, gauge, if special thickness is desired, and number of teeth.



Huther Bros. Smooth-Cutting Saws

Huther Bros. Inserted Tooth Milling Saws—Coarse Pitch Type

Recommended for cutting solid stock, either rounds or squares, $2\frac{1}{4}$ inches or more. The inserts are of the best quality high speed steel and can be worn down to practically $1\frac{1}{2}$ inch on the surface before it is necessary to replace them. The saw is thin, free-cutting, strong, flexible and practically non-breakable.

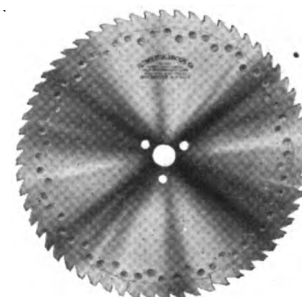


Huther Bros. Inserted Tooth Milling Saws Coarse Pitch Type

Huther Bros. Inserted Tooth Milling Saws—Fine Pitch Type

Practically the only fine pitch inserted tooth milling saws on the market. Unexcelled for cutting rails. Pitch varies from $\frac{3}{8}$ to $\frac{3}{4}$ inch or more—thereby giving a pitch equal to any solid tooth saw.

Used extensively for cutting small rounds and flats of structural steel. The body of the saw is made of special alloy steel, tempered for strength.



Huther Bros. Inserted Tooth Milling Saws—Fine Pitch Type

When possible, give us the opportunity of filling order from stock to approximate your specifications.

Huther Bros. Saw Mfg. Co., Inc., 1190 University Ave., Rochester, N. Y.

Indiana Quartered Oak Co.

228 East Avenue

Long Island City, N. Y.

Importers of

Philippine INDOAKO Wood—"Best for Schools"

Origin

Shortly after the Spanish-American war, through which the Philippine Islands became a United States possession, a group of Americans, realizing the possibilities offered in the almost limitless forests of the Philippines, secured a concession from the Government and erected a small sawmill, under great expense and difficulty, at Fabrica, Negros Occidentale, P. I., which is located about 300 miles south of Manila. Thus, twenty years or more ago, was exported to America, the first shipment of this fine wood of the Philippines. Here the use of the wood has grown tremendously, as its range of texture from plain, moderately soft, straight grained stock to firm, close textured figured wood, permits its use, when properly selected, for a wider variety of purposes than most competing woods. In fact, about 40,000,000 ft. are imported annually, and the manufacture of this lumber has become one of the leading industries of the Islands, where there are now many sawmills operating.

Supply and Facilities

We are the sole Eastern Sales Agents for the Insular Lumber Co. of Manila, who operate the largest and most modern mill in the Islands, with an output of about 1,000,000 ft. weekly. On our Yards here, we carry at all times, from three million to five million feet and monthly cargoes arriving, keep our stock replenished.

Characteristics

Philippine INDOAKO Wood has a rich color and shows a beautiful grain, particularly in the quartered stock which gives the "ribbon" grain effect not obtainable in domestic woods.

It is easily worked, stays put, does not readily split in nailing, and is strong and durable.

We import only the upper grades and therefore our stock runs free of knots—thus materially reducing the item of waste.



Moderate Cost

Due to a heavy stand of inexpensive timber, low manufacturing costs, moderate freight rates and freedom from import duty, Philippine INDOAKO Wood competes not only with the mahoganies, but with most domestic hardwoods as well.

Finish

The ease with which Philippine INDOAKO Wood adapts itself to a wide range of color effects is one of its most valuable characteristics. Natural oak, maple, silver grey, soft greens, old mahogany and walnut brown effects are readily obtainable. Leaflet giving suggestions for finishing, will be forwarded on request.

Nomenclature

"INDOAKO" is our registered trade-name for the wood which we formerly sold by the name "Philippine Mahogany." Your use of the term "INDOAKO" insures your getting our selected, guaranteed "Look for the Log" stock, of superior texture and quality.

School Grade

For Manual Arts work, we put up a grade which is Clear except for needle worm holes—so fine as to be almost microscopic, and which can be readily concealed in the finishing process. We can, of course furnish stock free from the needle holes, if desired, at an increased cost.

Our School stock is guaranteed dry. Moreover, all Philippine INDOAKO Wood furnished by us for School work, bears our trademark shown above, and we will replace, without charge, any stock bearing this mark which is found to be under grade.

Extensive Use for Manual Arts

The use of Philippine INDOAKO Wood in manual training work has grown tremendously. We will send list of schools using the wood, on application.

Write for circular, sample and price list

**In addition to Philippine INDOAKO Wood, we handle
PERUVIAN MAHOGANY, TEAK and other tropical woods.**

Indiana Quartered Oak Co., 228 East Avenue, Long Island City, N. Y.

The Irwin Auger Bit Company

Wilmington, Ohio

Manufacturers of

Irwin Auger Bits

The trademark to the right is stamped on the shank of every Irwin made bit. It is the mark of the originator and sole manufacturer of the genuine Irwin bit. The red and green tag attached to every Irwin bit shows on one side the name and stock number of the bit and describes the use. The reverse side of the tag carries our guarantee of the measure of service which the bit will deliver, and states that we stand behind your dealer.



The auger bit recommended for school shops is the Smoothbor Auger Bit No. 62-TS. This bit is particularly recommended for patternmakers and cabinetmakers, and for all such uses as an auger bit is called upon to perform in the average school woodworking shop.

LENGTH—Usual Auger Bit (see table).

CUTTING HEAD—Smoothbor (see drawing).

- (1) Screw with fine pitch of thread for extra smooth boring.
- (2) Spurs of length in keeping with pitch of screw.
- (3) Cutters designed for cutting smooth thin chips.
- (4) Throat opened for easy flow of chips.



SHANK—Tapered square to fit standard brace chuck.

FINISH—Polished.

PACKED—Sizes $\frac{1}{16}$ " to $\frac{1}{4}$ " inclusive, six in box. Also packed in a set.

Specifications

Sizes in 16th of an inch	Sizes in Fractions of an inch	Average Length of Twist in Inches	Average Length Over all in Inches
4	$\frac{1}{16}$	4	7 $\frac{1}{2}$
5	$\frac{1}{8}$	4 $\frac{1}{2}$	7 $\frac{3}{4}$
6	$\frac{3}{16}$	4 $\frac{1}{4}$	7 $\frac{3}{4}$
7	$\frac{1}{4}$	4 $\frac{1}{2}$	7 $\frac{3}{4}$
8	$\frac{5}{16}$	4 $\frac{3}{4}$	8
9	$\frac{3}{8}$	4 $\frac{3}{4}$	8 $\frac{1}{4}$
10	$\frac{7}{16}$	4 $\frac{3}{4}$	8 $\frac{1}{2}$
11	$\frac{1}{2}$	4 $\frac{3}{4}$	8 $\frac{1}{2}$
12	$\frac{5}{8}$	4 $\frac{3}{4}$	8 $\frac{1}{2}$
13	$\frac{3}{4}$	4 $\frac{3}{4}$	8 $\frac{1}{2}$
14	$\frac{7}{8}$	4 $\frac{3}{4}$	8 $\frac{1}{2}$
15	$\frac{15}{16}$	4 $\frac{3}{4}$	8 $\frac{1}{2}$
16	1	4 $\frac{3}{4}$	9

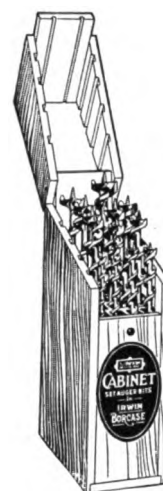
The Smoothbor Bit will carry itself into wood, cut a clean hole, finishing the hole neatly on the far side and turn easily without pressure on the brace. Auger Bit No. 62-TS has a fine pitch of thread in the screw for extra smooth boring. These bits are also obtainable with a fast screw and a medium screw. The spur is not too long or thick like a wedge. Its length is suited to the feed of the bit, with sufficient metal for strength brought to a cutting edge, but without unnecessary thickness which wedges and drags. The cutting lips have ample material to assure long life. The throat of an auger bit is important. There must be plenty of room for the chips to leave the cutting lips. The twist receives the chips from the throat and conveys them to the mouth of the hole. Ample room in the twist keeps the chips moving freely. The outside of the twist of a bit is ground so that the diameter of the twist is slightly less than the diameter of the head, in order to permit the twist to follow the head into the hole without friction. The shank of an Irwin Auger Bit is so manufactured as to have all four sides of exactly the same bevel, so that the bit will have no tendency to swing off center.

Cabinet Set 13 Bits in Borscase

The school set that is most popular is the Cabinet Set consisting of thirteen bits in Borscase—Stock No. DS. This kit consists of Irwin Smoothbor Auger Bits 62-TS in sizes 4, 5, 6,

7, 8, 9, 10, 11, 12, 13, 14, 15, and 16/16ths. There are a number of other Borscase sets that contain for instance only ten bits incorporating sizes 4, 5, 6, 7, 8, 10, 12, 14, and 16/16ths; another set that contains only six bits incorporating sizes 4, 6, 8, 10, 12, and 16/16ths.

Sizes 4 to 16/16ths inclusive, are packed six in a box. They can also be ordered in this manner.



Dowel-Bit No. 61-T

Dowel Bit No. 61-T is especially recommended for boring short, accurate holes such as dowel pin holes and similar work. LENGTH—4 $\frac{1}{2}$ " over all.

CUTTING HEAD—Smoothbor (see drawing).

The screw of Dowel Bit No. 61-T has a fine pitch of thread for extra smooth boring. The body of the bit is the same as that of No. 62-TS previously described, possessing all its features and advantages. However, its length is only 4 $\frac{1}{2}$ in. over all.



Specifications

Sizes in 16th of an inch	Sizes in Fractions of an Inch	Average Length of Twist in Inches	Average Length Over all in Inches
3	$\frac{1}{8}$	3	4 $\frac{1}{2}$
4	$\frac{1}{4}$	3	4 $\frac{1}{2}$
5	$\frac{3}{8}$	3	4 $\frac{1}{2}$
6	$\frac{1}{2}$	3	4 $\frac{1}{2}$
7	$\frac{5}{8}$	3	4 $\frac{1}{2}$
8	$\frac{3}{4}$	3	4 $\frac{1}{2}$
9	$\frac{7}{8}$	3	4 $\frac{1}{2}$
10	1	3	4 $\frac{1}{2}$
12	$\frac{3}{4}$	3	4 $\frac{1}{2}$
14	$\frac{1}{2}$	3	4 $\frac{1}{2}$
16	$\frac{1}{4}$	3	4 $\frac{1}{2}$
20	$\frac{1}{8}$	3	4 $\frac{1}{2}$

Manual training instructors will find this illustrated 48-page booklet a real help in promoting class interest and an appreciation of good tools.

There are detailed illustrations showing how bits are forged and machined, the parts of a bit and their functions, how to sharpen a bit properly, how to re-straighten the twist and how the design of the cutting head is varied to meet the requirements of the different classes of work.

A wealth of interesting and authoritative data based on 41 years of experience in the bit making industry.

Sample copies sent free of charge.



The Irwin Auger Bit Company, Wilmington, Ohio

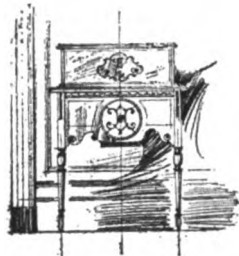
Klise Manufacturing Company, Inc.

Grand Rapids, Michigan

Manufacturers of

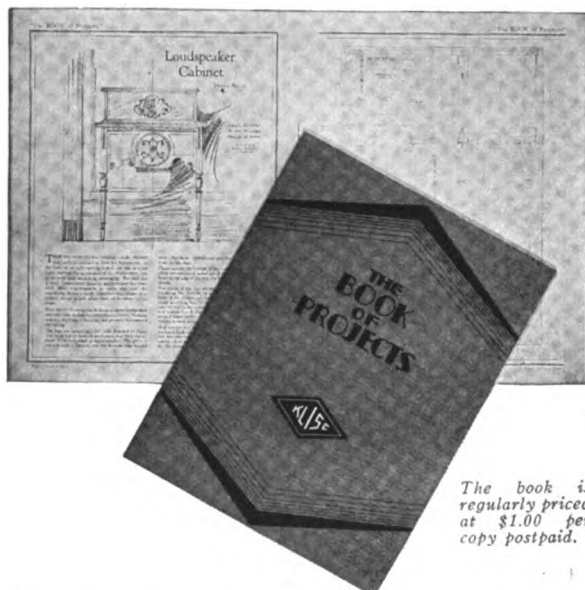
Wood Carvings, Mouldings, Ornamentation

When you have taught a student co-ordination of brain and hand you have opened a new avenue of expression; and when you have furnished materials for the building of beautiful things you have gone a long way in sending the student out into the world a better citizen. The use of carved wood mouldings is general on all



the better grades of furniture. The finishing touch obtained through its application lifts the piece out of the ordinary class and imparts to it character, distinctiveness and saleability. We might add one more feature—**BEAUTY.**

"Book of Projects" now Available



The book is regularly priced at \$1.00 per copy postpaid.

Said by great educationists to be "the most valuable work in the field"—"of inestimable value to every vocational student and teacher and every home worker" this book, the work of the foremost furniture designers, collaborating with educational leaders of national and international prominence, has been made available to schools, teachers, students and home workers.

All the projects—many pages of them are illustrated in completed form and with full detail drawings and specifications. There are projects for the beginner and for the most advanced students.

The last few pages of the book are devoted to carved wood and its application to the projects, illustrating many of the beautiful designs obtainable from Klise Manufacturing Company, Inc.



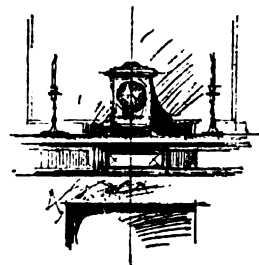
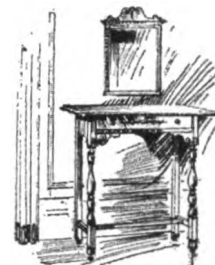
Directors and supervisors of vocational instruction may obtain authors copies of this book with the compliments of the publishers by writing on their school letterhead and giving their position with the school.

It is the desire of the Klise Manufacturing Company, Inc., to be of service to both students and teachers and will welcome correspondence in regard to the use of carved wood decorations for projects or for any other purpose.



The ordinary every day project of the vocational shop may be lifted out of the ordinary by treating it as the finer pieces of furniture are treated in the shops of the best furniture makers. It can be made an achievement in fine cabinet making through the application of carved wood mouldings.

After careful cooperation with educational leaders and with some of the greatest furniture designers, Klise Manufacturing Company makes available to the Vocational Shops the materials with which to build these more beautiful pieces.



It contains many new projects, with complete plans drawn to scale; it contains suggestions for both student and teacher; it shows forms of decoration hitherto given only to makers of high grade furniture.



A Free Bag of Samples

In order to show the types of mouldings, etc., available, we have prepared a bag of samples which will be sent free on request. Mouldings and decorations for any project of your own design or for those shown in our book may be obtained at very reasonable prices. Send for samples and full information.

Klise Manufacturing Company, Inc., Grand Rapids, Michigan

Lux Machine Company

22 East Hennepin Ave., Minneapolis, Minn.

Manufacturers of

Modern Woodworking Machinery

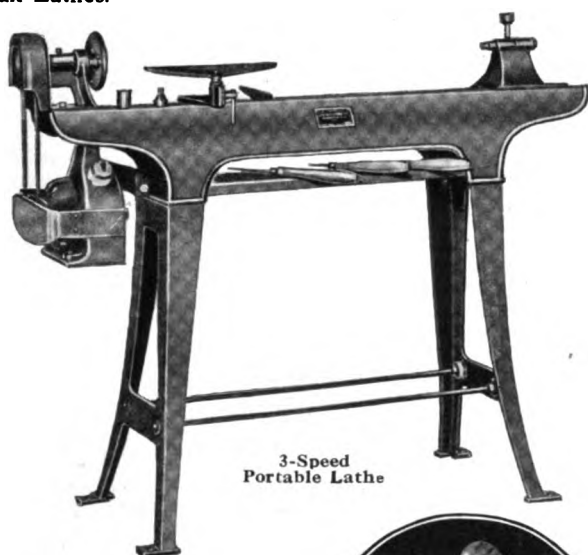
Protected by Patents

Lux Machines possess certain characteristics which render them particularly suitable for the school shop. Safety, simplicity, and ease of operation have been developed to a point where Lux Machines are almost fool-proof. Ruggedness and stamina have been



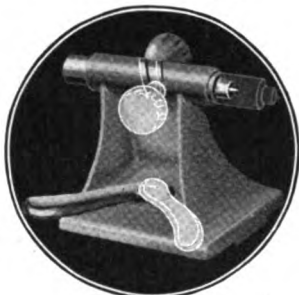
Lux Lathes

Individual motor drive is now conceded to be vastly superior to group drive. Countershafts and overhead drive are an ever-present source of danger and a menace to health through the agitation of the fine dust particles that cover walls and ceilings. Flexibility or portability is also practically impossible without independent motor drive. All Lux Lathes are therefore equipped with independent motor drive. Variable speed motors are rapidly losing favor in industry because of their higher cost, lower efficiency and greater upkeep expense. No variable speed motors are used on Lux Lathes.



3-Speed
Portable Lathe

The Lux method of suspending the motor below the bed is safer because it places the belt out of the way. It conserves floor space. It gives nicer balance and it provides the most simple means of securing reliable automatic belt tension.



Headstocks are equipped with thrust type S.K.F. ball bearings. The outside end of the spindle carries a three-step cone pulley (four-step for type B Lathes), this providing the most reliable and fool-proof method of speed control and insuring full power at each speed.

The Lux tailstock is unique. Simply throw the knob over and give it a turn to lock the bolt in place. A quick acting lever locks the sliding tailstock at any position on the bed.

Types of Lux Lathes

The Three-Speed Portable Model is a light, strong, fast lathe available in two sizes: 8" or 10" swing. Either size may be had with 34" or 42" centers. Most popular for general school use.

Type B Lathes are larger, 4-speed machines of the same general design. They are available with 12" or 16" swing, 44" or 68" between centers. Fully equipped with Allen-Bradley push button control and overload and low voltage protection. Slow speed of 400 R.P.M. for safe turning of large work on outside faceplate. Ideal for instructor's or student's use.

built in, but care has also been taken to avoid any appearance of bulkiness or clumsiness. As a consequence, Lux Machines are graceful, trim, attractive, and an inspiration to good workmanship. They are ideal equipment for the school shop and recommended by some of the best men in the field.

Specifications—Three-Speed Portable Lathe

Motor—Single speed repulsion type. 8" swing— $\frac{1}{4}$ H. P. 10" swing— $\frac{1}{2}$ H. P. Standard motor is 110 volt, 60 cycle. Other types at slight additional cost.

Speed—About 1000-1725-3000 R.P.M.

Spindle—Steel, in S.K.F. ball bearings.

Drive—Endless belt, provided for stretch take-up.

Bed—One-piece. Machined for accuracy and sliding ease. 3'-4" or 4'-2" long.

Base—Light, strong, practical, attractive.

Equipment—One 5" faceplate, one screw chuck, one spur center, one cup center, one 12" and one 6" tool rest, 10' cord and plug.

Specifications—Type B Lathe

Motor—Single speed repulsion type. 12" swing—1 H. P. 16" swing— $1\frac{1}{2}$ H. P. 110-220 volt, 60 cycle is standard. Other types at slight additional cost.

Speed—About 400-1000-1750-3000 R.P.M.

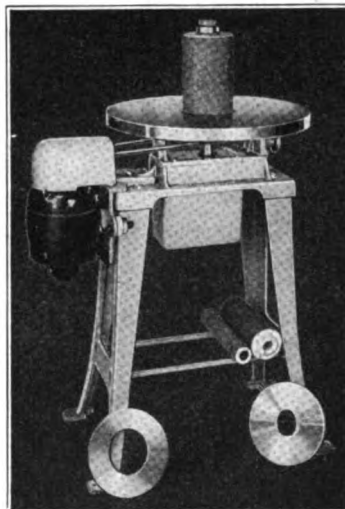
Spindle—High grade steel, running in S.K.F. thrust ball bearings.

Bed—Cast in one piece and carefully machined. 5' and 7' beds are standard. Other lengths on special order.

Equipment—Complete with motor and Allen-Bradley control. One spur center, one cup center, one cone center, one outside faceplate, one inside faceplate, one screw chuck, one 8" and one 14" tool rest.

No. 1 Sander and Grinder

The No. 1 Sander and Grinder is unusually quiet running. Takes spindles from $\frac{1}{8}$ in. to $1\frac{1}{2}$ in. diameter. Spindle turns 2400 R.P.M. Bearings run in oil and are completely enclosed. Motor is mounted on a sliding bracket, adjustable for belt tension. A neat guard covers all moving parts except the sanding drum. The belt arrangement gives the most practical speed on the spindle.



Specifications

Motor— $\frac{1}{4}$ H.P.

Speed—2400 R.P.M.

Belt—Endless. Arrangement provided for stretch take-up.

Table—15 in. diameter, tilts both ways.

6 Spindles— $\frac{3}{8}$ ", $\frac{1}{2}$ ", $\frac{3}{4}$ ", 1", $1\frac{1}{4}$ ", $1\frac{1}{2}$ "; 5"-6" long, standard equipment.

Templets—Furnished for forming paper and emery cloth, to fit spindles.

Oscillation—1 in.

Left—No. 2 Sander
Below—Drum and Attachment for No. 2 Sander

No. 2 Sander and Grinder

A larger machine having 22-in. diameter table. Takes spindles from 2 to $5\frac{1}{2}$ in. diameter and 10 in. long. The oscillation in this machine is $1\frac{3}{4}$ in.

Specifications

Motor— $\frac{1}{2}$ H.P. repulsion type.

Belt—Endless. Arrangement provided for stretch take-up.

Speed—2000 R.P.M.

Table—22 in. diameter, tilts both ways.

Spindles—2, $3\frac{1}{2}$ ", $5\frac{1}{2}$ in.—10 in. long.

Oscillation— $1\frac{3}{4}$ in.

Drum Attachment

This attachment converts the No. 2 Spindle Sander into an oscillating Drum Sander. Boards up to 8" wide can be finished very smooth.



Luther Grinder Mfg. Co.

291 C So. Water Street
Milwaukee, Wis.
Manufacturers of

Luther Grinders, Vises, Grinding Wheels

FARM SHOP

GENERAL WOOD AND METAL SHOP

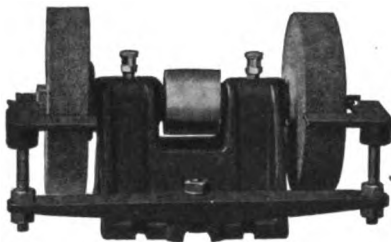
6", 7", 8", 10" Power Bench Grinders



Power Bench Grinder
No. 310

Luther Power Bench Grinders are made in a variety of styles well adapted to school shop use. They come complete with adjustable tool rests and two Dimeo-Grit wheels—one medium and one coarse.

No. 310, shown at the left, above, is perhaps best for all-round school use. Wide, dustproof, babbitt bearings have spring oilers and are adjustable for wear. Wheels measure $7 \times 1\frac{1}{4} \times 1"$. May be driven from the side or from above. No. 309 is same as No. 310 but does not have idler pulley. 8" and 10" sizes also made by us.



Power Bench Grinder No. 306

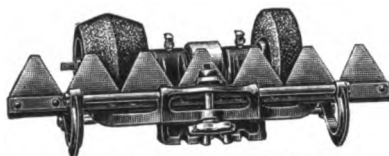
No. 306 is a sturdy, low priced grinder. Wheels measure $6 \times 1\frac{1}{4} \times 1"$. Equipped with self-closing oilers. A $\frac{1}{4}$ H.P. motor will drive it.

Luther Farm Tool and Sickle Grinders

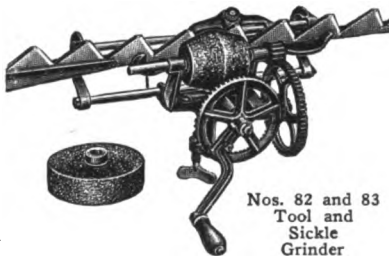
Modern methods aid greatly in teaching general tool and sickle grinding, also disc grinding.

No. 307 Power Bench Type Grinder handles practically every grinding job in the farm shop. Complete with $6 \times 1\frac{1}{4} \times 1"$ medium Dimeo-Grit wheel for tool grinding, $5\frac{1}{2} \times 3\frac{1}{2}"$ double bevel face wheel for sickle grinding, adjustable work rest for tool wheel, sickle holding attachment, and attachment for grinding discs.

Nos. 82 and 83 are hand operated. No. 83 has bevel face wheel and 4" tool grinding wheel. No. 82 does not have the tool wheel. Both have improved sickle attachment. Several other sizes of different designs are available.



No. 307 Power Bench Type



Nos. 82 and 83
Tool and
Sickle
Grinder

Luther Farm Foot Power Grinders

No. 271 known as the "HUMMER" Grinder is especially made for shop and general grinding where power is not available. Ample power and speed is available for all work, in fact, it will easily outperform many a good-size power driven grinder. All metal construction; swiveling head; ball bearings; adjustable work rests; $6 \times 1\frac{1}{4} \times 1"$ medium and coarse grit wheel; also special sickle grinding attachment and disc grinding attachment which takes discs of any size.



"Hummer" Grinder
No. 271

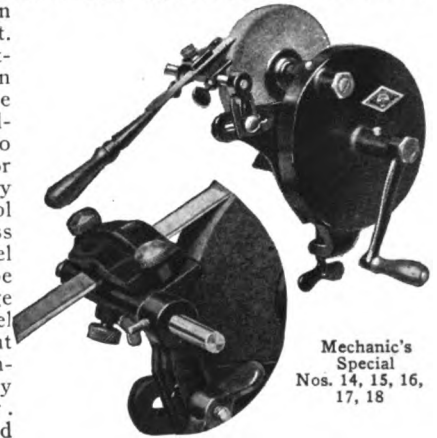
Luther Hand Power Tool Grinders

These "MECHANIC'S SPECIAL" Grinders are heavy duty tools for fast accurate work. Highest type of construction and best materials are used throughout. Standard equipment includes a fully adjustable tool rest and a chisel and plane iron holding attachment.

By means of this attachment the boys in your shop can give a perfectly true, hollow-ground edge to any plane bit or chisel by simply drawing the tool back and forth across the edge of the wheel—the bevel will be uniform and the edge keen. The chisel holding attachment may be used in connection with any Luther Grinder.

May also be used with other makes of grinders if a suitable mounting attachment is available. Many other power grinders from which to make a selection for your shop needs.

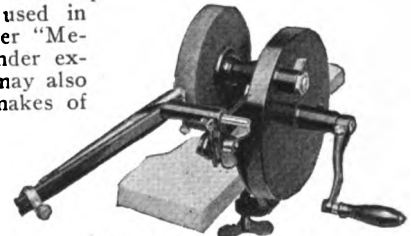
Number	14	15	16	17	18
Wheel size	$4 \times 1 \times 1"$	$5 \times 1 \times 1"$	$6 \times 1 \times 1"$	$7 \times 1\frac{1}{4} \times 1"$	$8 \times 1\frac{1}{4} \times 1"$



Mechanic's
Special
Nos. 14, 15, 16,
17, 18

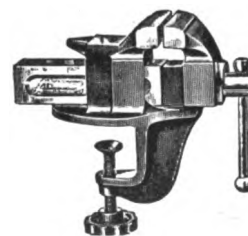
Luther Tool and Twist Drill Grinders

The Luther Twist Drill Grinding Attachment as supplied with No. 175 enables a novice to correctly sharpen any twist drill from $\frac{1}{4}"$ to $1"$. The attachment assures the accuracy of the cutting angle and the necessary back clearance for either straight or taper shank twist drills. This attachment may be used in connection with Luther "Mechanic's Special" Grinder except the No. 14. It may also be used with other makes of grinders if a suitable mounting attachment is available. No. 175 includes the twist drill attachment and the chisel and pipe die holding attachment described above. No. 177 includes these and in addition, a redresser, flat drill attachment, and adz attachment.



No. 175 Tool and Twist
Drill Grinder

Luther Portable Clamp Vises



Number
Width Jaws
Opening Jaws
Weight, lbs.

V91	V92	V92 1/2	V93
$1\frac{1}{2}"$	$2"$	$2\frac{1}{2}"$	$3"$
$2"$	$2\frac{1}{4}"$	$3"$	$3\frac{1}{4}"$
$3\frac{1}{2}"$	$6"$	$9"$	$11\frac{1}{2}"$

A portable clamp vise is needed in every home and shop tool-kit. Saves knuckles and time on tinkering and repair jobs, with the advantage of mounting anywhere, and bringing the vise to the job.

Built to last—extra wide jaw faces—wide opening of jaws increases utility—every detail designed for maximum service.

Luther 6" Electric Bench Grinder

May be bolted to bench or mounted on floor stand. Completely equipped; $\frac{1}{4}$ H.P. motor, cord and plug, control switch, wheel guards, work rests, one 6×1 and one $6 \times \frac{1}{2}"$ Dimeo-Grit wheels, and handy carrying handle. Chisel holding attachment similar to one illustrated under hand power grinders; can be supplied at low cost. Assures accuracy and rapid work. Excellent addition for any school shop.

Luther Grinder Mfg. Co., 291 C So. Water Street, Milwaukee, Wis.

Minnesota Mining & Manufacturing Co.

St. Paul, Minnesota

Manufacturers of

Sandpaper For Every Purpose

An important change, from the standpoint of Industrial Schools, has occurred in abrasives within very recent times. The old familiar "sandpaper" and emery cloth are no longer representative. Special cutting minerals have been manufactured, improved grading is in effect, and abrasives have been "tailored" to fit the job and surface sanded. Obviously it is particularly desirable that schools be equipped to send out graduates fully acquainted with new developments, and we are always glad to cooperate with free samples or other means of information. In calling upon us for this you will be accepting the facilities of one of the world's largest producers of coated abrasives.



For Woodworking Shops

Flint Paper

With extreme sharpness due to the Three-M Process of grading and coating, Three-M Brand Flint Paper and Imperial Flint Paper are satisfactory for ordinary short work sanding or on the softer woods. Three-M Brand Flint Paper is made in the regular 9 x 11 sheets, coated with the best grade of Flint obtainable, and has a backing which will not tear easily. Imperial Flint Paper, made in 8 3/4 x 10 1/2 inch sheets, has the same high grade Flint mineral and, therefore, the same sharpness as the Three-M Brand Flint Paper. Both are put up in quire and half ream bundles, and Three-M Brand Flint also comes in 50 yard rolls, all widths up to 24". Grit numbers are as follows: Three-M Brand Flint Paper in grits 4/0, 3/0, 2/0, 1/0, 1/2, 1, 1 1/2, 2, 2 1/2, 3, and 3 1/2. Imperial Flint Paper from 3/0 to 3, inclusive.

Garnet Paper

On woodwork where a harder mineral than Flint is needed Three-M Garnet Paper or Cutrite Garnet Paper are recommended. Three-M Garnet Paper has the regular mineral coating while Cutrite Garnet Paper has a spread mineral coating. Cutrite is the trade name for spaced distribution of mineral, the spaces preventing filling up of the grit. Cutrite coating is therefore better to use on materials which tend to clog the cutting surface of ordinary sandpaper. Three-M Garnet Cabinet Paper and Cutrite Garnet Cabinet Paper are the types of sandpaper generally used for the sanding or surfacing of wood "in the white." They are adaptable also for sanding plastic material.

Cutrite Garnet Finishing Paper is so called because it is used in preparing the surface for the final coat of varnish in sanding upon coated or varnished surfaces. It produces an undersurface over which the final varnish, enamel, etc., settles to a perfect finish.

Three-M Garnet Cabinet Paper and Cutrite Garnet Cabinet Paper are made in grits 4/0 to 3 1/2, inclusive. Cutrite Garnet Finishing Paper is made in grits 7/0 to 1/0, inclusive. They are put up in quire and half ream bundles. Three-M Garnet Paper, made in grits 4/0 to 3 1/2, inclusive, also comes in 50 yard rolls of 3 inch to 48 inch widths.

Production Paper

On hardwood where the toughest possible sandpaper is needed Production Paper will be found superior to Three-M Garnet Paper or Cutrite Garnet Paper. Production has an artificial mineral which gives it the additional toughness to out-wear and out-rub Garnet Paper. It has a semi-open coating of the grit which prevents filling. Production Paper is made in grits 7/0 to 3 1/2, inclusive, and put up in quire and half ream bundles. It also comes in 50 yard rolls, grits 4/0 to 3, inclusive, in 3 inch to 48 inch widths.

**PRODUCTION
PAPER**

MADE BY THE



Scotch Masking Tape, for Automobile and Furniture Paint Masking

Scotch Masking Tape is furnished in 72 yard rolls, in widths from 1/4" to 26" for the purpose of masking spray and brush painting, to secure a clean cut distinction of colors when more than one color is used. This product is a rubber adhesive tape, with a flexible paper backing, leaving a clean cut thin edge for paint masking. The backing is flexible enough to make the necessary turns and curves. This product is also very useful in masking wood trim for interior decorating and industrial painting.

For Machine Shops

Three-M-ite Cloth

Three-M-ite is a metal cutting abrasive made in the electric furnace. Unlike Emery, which is a natural mineral and varies somewhat in quality, Three-M-ite is always the same. Every inch of grit and every crystal in the inch cuts. It cuts without heat and is a non-conductor. It is the result of scientific effort to give the metal industry a perfect abrasive. In large plants throughout the country this form of abrasive has entirely replaced Emery. Put up in quire and quarter ream packages, Three-M-ite Cloth comes in grits 320, 240, 180, 150, 120, 100, 80, 60, 50, 40, 36, 30, and 24 in sheets 9x11 inches. Three-M-ite Cloth Rolls come in 50 yard length from 2 1/2 to 28 inches wide.



A handy form of abrasive for any machine shop is the Three-M-ite Cloth Utility Roll shown at the left, a fifty yard strip made in all regular grits and in 1, 1 1/2, and 2 inch widths, and wound on a spool.

Emery Cloth

Crystal Bay Emery Cloth, coated with Turkish Emery, is put up in half ream packages of 9x11-inch sheets, and in 50-yard rolls 24 inches wide, and comes in the following grits: 3/0, 2/0, 1/0, 1/2, 1, 1 1/2, 2, 2 1/2, 3, and 3 1/2.

For Wet Sanding Painted Surfaces

In wet-sanding varnishes, enamels, lacquers, etc., Wetordry, the original waterproof sandpaper, used with water will do the job as thoroughly as pumice stone or rottenstone in much less time, and leave a dead level finish. It comes in two kinds of grit coatings. Wetordry Garnet Paper is coated with natural Garnet and is suitable for wet-sanding varnished or enameled surfaces. Wetordry Tri-M-ite Paper is coated with the hardest, sharpest mineral made, greatly outlasts Garnet on hard surfaces, costs about twice as much, and is used mostly in sanding down lacquer. Wetordry Garnet Paper is made in grits 8/0 to 1/0, inclusive, and Wetordry Tri-M-ite Paper in grits 400 to 60, inclusive. Both come in quire and half ream bundles.



Minnesota Mining & Manufacturing Co., St. Paul, Minnesota

Modern Grinder Mfg. Co.

Milwaukee, Wis.

Manufacturers of

Grinders, Vises, Planes

MODERN Superior Quality Tool Grinders are built by the world's largest manufacturer of hand tool grinders and excel in quality of material and workmanship as well as in design. The MODERN line is not built to meet price, yet quality production and unequalled manufacturing facilities enable us to offer higher quality tools at each price level. In line with MODERN quality is MODERN service. Shipments from the factory are prompt and the many dealers offer a convenient local source of supply. Each MODERN tool is guaranteed absolutely against defective material and workmanship.

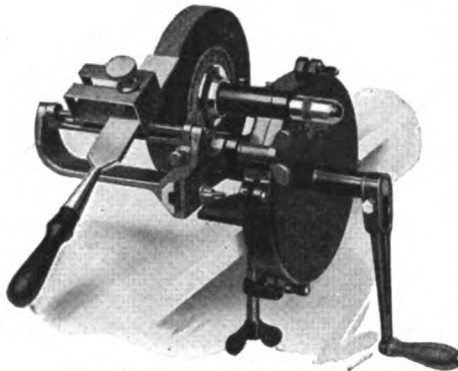
MODERN
SUPERIOR QUALITY

MODERN Tool Grinders employ the highest grade specially bonded, vitrified abrasive wheels especially adapted for use on hand tool grinders. These wheels are fast and free cutting yet hard enough so

that they will keep their shape under hard usage and will not groove easily. This is an extremely important point in selecting hand tool grinders.

MODERN Grinding Heads, Vises and Planes are built to the same high standards established for MODERN Tool Grinders and each is backed by the same guarantee. The Planes employ genuine Swedish Cutters hardened and tempered by the famous Swedish method.

Liberty Model

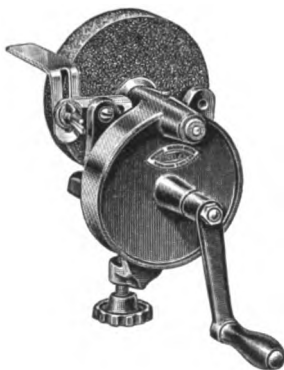


The highest grade hand power grinder. A powerful fast cutting grinder built for hard service. Attachments available for sharpening twist drills, chisels, plane irons and dressing wheel. Finished in baked black enamel. Size of grinding wheel 7 x 1 3/8 x 1 inches. Highly recommended for the school shop.

List Prices

Grinder	\$19.00
Twist drill attachment.....	10.00
Chisel and plane iron attachment.....	5.60
Wheel dressing attachment.....	3.35
Weight 32 lbs. packed 1 to a box.	
The above cut shows chisel and plane iron grinding attachment on grinder.	

Model J Medium Priced Grinder



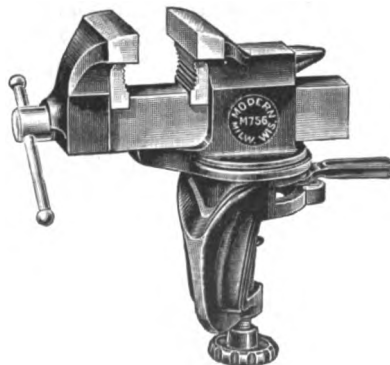
Each size of the Model J has an individual gear case, with large gear, long bearings, heavy pinion and crank shaft, all built proportionate with the size of the grinding wheel. Gear pinion is housed in a long one-piece bearing; crank shaft has bearing at each end. Tool rest, adjustable to either side of wheel. Accurately machine cut gears, quiet and smooth running.

Model	Wheel	Weight	Price
J4	4 x 7/8 x 1/2	5 1/2 lbs.	\$2.75
J5	5 x 1 x 3/4	8 3/4 lbs.	3.52
J6	6 x 1 x 3/4	11 lbs.	4.78
J7	7 x 1 x 3/4	13 1/2 lbs.	6.49

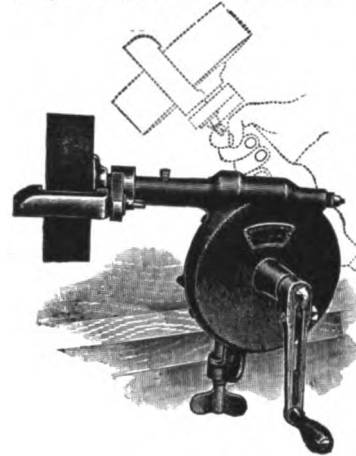
Portable Swivel Bench Vises

Has all features of the regular light Shop or Garage Vise, and in addition, the clamping feature which makes it portable. Take the Vise to the Job!

Positive swivel lock. Malleable iron nut and clamping lever. All faces accurately milled. Polished jaws and anvil. Cold rolled steel, wheel-grip clamp screw. Malleable pipe jaws. Baked enamel finish.



No.	Jaw	Spread	Weight	List
M756	3 in.	3 in.	12 1/2 lbs.	\$4.40
M756P	3 in.	3 in.	13 lbs.	4.60

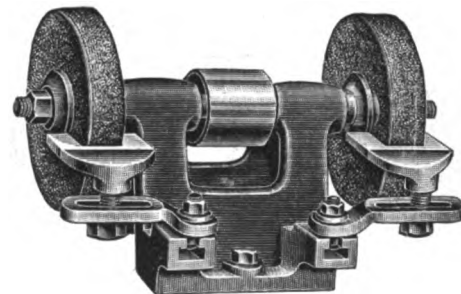


Tilting Grinder No. 6

A high grade grinder especially recommended for broad-edge tools. Accurately machine cut helical gears operate smoothly and give high wheel speed. Ball bearing shaft is set at 20 deg. angle to large gear axis to clear handle. Entire gear case and shaft tilt 90 deg. to vertical position. Adjustable tool rest. Malleable iron clamp. Finished in baked black enamel.

Size of wheel, 5 x 1 1/2 x 1 inches. Weight, 14 lbs. List\$11.00

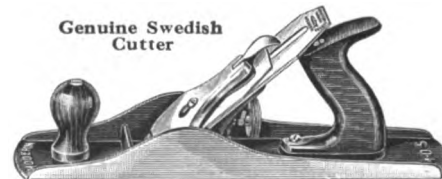
Model P127 Grinder Head



Frame so constructed that belt can be run over pulley directly from underneath. Equipped with one medium and one coarse wheel, size 7 x 1 1/4 x 5/8 inches. Black finish.

Distance betw. wheels, in.....	8 1/2	Size of pulley, in.....	2 1/2 x 2
Length of bearings, in.....	2 1/4	Bench space required, in.....	5 1/2 x 5 1/4
Diameter of spindle, in.....	3/4	Weight each, lbs.....	19
Diam. of spindle betw. flanges, in.....	3/4	Each, list price.....	\$8.15

Modern Adjustable Bench Planes



Genuine Swedish steel cutter. All cutters are adjustable to the finest degree, sideways, and up and down. The frog is of the most popular and rigid type. Modern planes are finished in two colors, maroon and black with brightly polished surfaces and neat brass screws and nuts. Handles and knobs are finished in rich brown mahogany.

Available in Block, Smooth, Jack and Fore Planes from 6" to 18" long with Swedish steel cutters from 1 1/2" to 2 3/4" wide. Priced from \$1.60 to \$6.56 list. Send for catalog.

Modern Grinder Mfg. Co., Milwaukee, Wis.

Morgan Vise Company

108 No. Jefferson St., Chicago, Ill.

Manufacturers of

Wood and Metalworking Vises

Morgan vises are guaranteed against breakage and we will replace free of charge any part broken in service. Morgan Woodworking Vises are distinguished by their simplicity of construction, and every part is accurately machined and interchangeable. In Morgan Metalworking Vises, the sliding bar is solid instead of cored all the way through as in other vises.

General Construction

The following details of construction are found in all Morgan Vises:

Castings. Castings are made of charcoal iron, which is an iron of an unusual degree of fineness. Ordinary gray iron is very porous, and while strong, has not the long life qualities of charcoal iron. The breaking strain of charcoal iron is about 40% greater than for gray iron. In the metalworking vises the sliding bar is accurately milled and properly fitted to the opening which is broached by special, heavy, expensive machinery.

Jaws. Jaws are all accurately milled and absolutely parallel to insure a square grip. The machinists' vises have interchangeable tool steel faces which may be replaced when worn, adding years of life to the vise at practically no cost. Any of the woodworking vises may easily be fitted with wood faced jaws if desired.

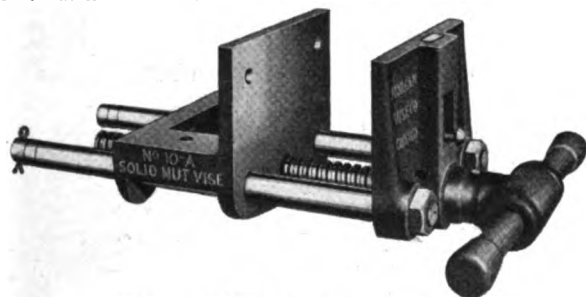
The Screw. All screws are manufactured from No. 1020 S. A. E. stock. This is a special, tough, non-stretching metal which makes it impossible for the screw to bind in the nut. Threads are Acme die cut, according to requirements.

The Nut. In the woodworking vises the nuts are extra hard bronze with carefully cut threads. A high grade malleable iron is used in all metalworking vises, eliminating possibility of breakage. Extra length provides a long bearing for the screw and promotes long life.

Slide Bars. $\frac{3}{4}$ " cold rolled steel is used in the woodworking vises and they slide freely in the back jaw regardless of opening or grip.

Solid Nut Continuous Screw Woodworking Vise

Side bars of $\frac{3}{4}$ " cold rolled steel with heavy shoulders fitting well into the movable jaw add strength and rigidity. Screw is 1" in diameter with three Acme threads to the inch assuring easy rapid action. Solid bronze nut is removable.



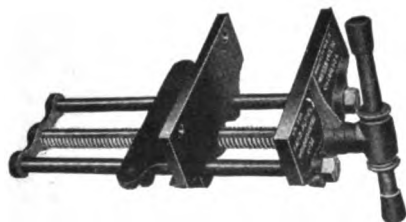
Morgan Solid Nut Continuous Screw Vise.

Vise No.	Width of Jaw Inches	Depth of Jaw Inches	Jaw Opens, Inches
10A	7	4	8½
15A	8	4	10
20A	10	4	12

No. 10A Vise can be furnished with 12-inch opening if so desired.

Quick Action Vise (Toles Pattern)

The working action of this vise is the most simple and effective of any of the screw adjusting type. The screw, having intercepted threads, operates in a half nut, a slight turn of the handle disengaging the screw and permitting the jaw to slide back and forth at will. A turn in the opposite direction engages screw with nut, holding the work firmly in place.

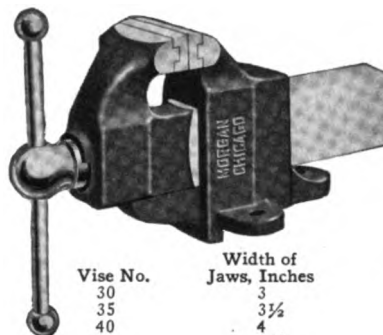


Morgan Quick Action Vise (Toles Pattern)

Screw is $1\frac{1}{4}$ " in diameter. Half nut is a high quality bronze casting with accurately cut threads. This vise can be furnished either with or without dog in the front jaw. Whenever dogs or stops are furnished they are accurately fitted into machined holes having cored openings at their bottoms to permit the passage of dirt and chips.

Vise No.	Width of Jaw Inches	Depth of Jaw Inches	Jaw Opens, Inches
100	7	4	8
200	10	4	12

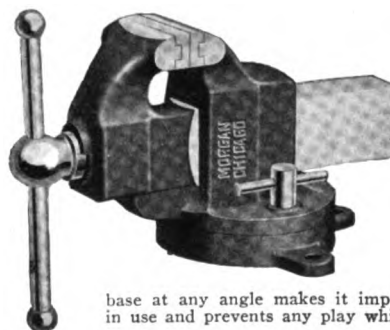
Stationary Base Machinists' Vise



This vise is unsurpassed for strength, rigidity, and durability. All parts are interchangeable because of the use of special machining processes.

Vise No.	Width of Jaws, Inches	Jaw Opens, Inches	Weight Pounds
30	3	4	22
35	3½	5	29
40	4	5½	42
45	4½	6¼	55
50	5	7	70
55	5½	8½	100
60	6	9½	135
70	7	12	200
80	8	12	250

Swivel Base Machinists' Vise

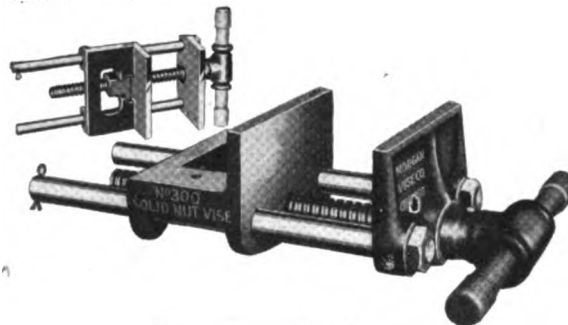


All the strength and rigidity of the Morgan Stationary Base Vise is maintained in the Swivel Base series. All engaging parts are milled to insure smooth and perfect working. The same careful workmanship and close and high standard of inspection is maintained in the manufacture of this type of vise. This vise may be swung and clamped in any desired position; a specially designed nut for locking the base at any angle makes it impossible to turn the vise when in use and prevents any play which would destroy the rigidity.

Vise No.	Width of Jaws, Inches	Jaw Opens, Inches	Weight Pounds
130	3	4	28
135	3½	5	36
140	4	5½	52
145	4½	6¼	64
150	5	7	85
155	5½	8½	115
160	6	9½	150
170	7	12	220

Junior Solid Nut Vise

Built to meet the demands for a sturdy dependable vise at a low price. Especially adapted for the Elementary Manual Training shop or the home work bench.



Morgan Junior Solid Nut Vise.

Construction and workmanship of the same high quality as our regular line and also carries our unqualified guarantee against breakage.

Vise No.	Width of Jaw, Inches	Depth of Jaw, Inches	Jaw Opens, Inches
300	7	3	8½

Can be furnished with 12" opening if so desired.

Other Models

The Morgan Vise Company also manufactures a Combination Pipe Vise with swivel base that is so constructed as to embody the best features of our standard machinists' vise and the convenience of a pipe vise. This vise is made in width of jaw sizes of 3½, 4½, 5, and 6 inches.

Morgan Vise Company, 108 No. Jefferson St. Chicago, Ill.

Mummert-Dixon Co.

Hanover, Pennsylvania

Manufacturers of

Oilstone Tool Grinders and Grinding Attachments

The oilstone tool grinder is now generally accepted as the only efficient, effective and proper method of sharpening edge tools used in the woodworking shops. The number of school and commercial shops still clinging to the out-of-date methods of the old style grindstone, bench whetstone and emery wheel, is rapidly declining because it is recognized that a correctly sharpened tool is the fundamental base upon which the success of every woodworking operation depends. Pioneering the field for over twenty years, the Mummert-Dixon Company developed the oilstone tool grinders which are now so widely used. The five fundamental features of these machines give all that could be desired in a tool grinding and general grinder. The COARSE OILSTONE WHEEL takes the place of the ordinary grindstone, is quicker and more effective. The FINE OILSTONE

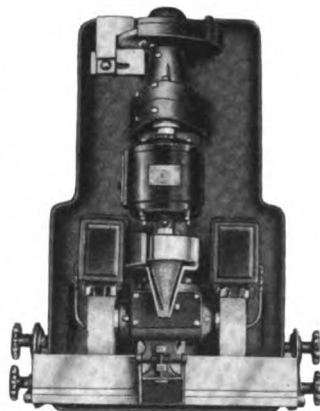
No. 475 Plurality Oilstone Grinder

This latest type oilstone grinder has been carefully designed, combining in a compact arrangement all the essential features of older models which have been giving excellent service for many years. The machine will meet the demands of all school shops where a small grinder is desirable. It will rapidly grind and sharpen all woodworking tools



such as plane bits, chisels, gouges, and the various bench tools. All the operative units are accessible from two adjacent sides and it is, therefore, very economical in its space requirements. Each unit is thoroughly guarded and so located that the operator can use it without danger from other units—a safe machine for school use.

Left, No. 475 Plurality Oilstone Grinder showing two operating sides. Below, Top view of No. 475, showing relative location of the separate units.



Construction: The column is a one-piece hollow casting. To the top of the column is secured the one-piece cast-iron pan in which all the units are set. This pan catches all oil and grit and also serves as a tray to hold tools.

Ball Bearings: Highest grade ball bearings are used throughout, making the drive almost frictionless and giving excellent power efficiency.

Drive: Either A.C. or D.C., 110 or 220-volt motor is centrally mounted and connected to the emery wheel shaft through a non-rigid coupling. The oilstone arbor is driven through a train of silent gears inclosed in oiltight cases.

Electrical Accessories: No starting rheostat is used. The electric switch is mounted directly on the side of the motor where it is instantly accessible from either of the operating positions. A cord of sufficient length to allow light socket operation is provided.

Oilstone Wheels Automatically Saturated: The two oilstone wheels, one coarse, for rapid abrasion and the other fine grained, for putting the smooth, keen edge to the tools, are kept saturated with kerosene which is directed from two oil reservoirs controlled by faucets through tubes to the cup part of the wheels. The oil is driven out through the pores of the wheels by centrifugal force, keeping them clean and preventing glazing and also keeps the tool from heating. Special appliances prevent an over-accumulation of oil on the face and also prevents it from flying off.

Stropping Wheel: The leather stropping wheel for removing wire edges and putting the finishing touches to the tools is mounted adjacent to the motor behind the grinding cone.

Grinding Cone: The grinding cone is mounted in front of the stropping wheel on the end of the ball-bearing motor shaft and is used for grinding gouges and irregular shaped tools.

Emery Wheel: This wheel is carried on the outer end of the ball-bearing shaft to which the motor is coupled. It is for general dry grinding.

Emery Wheel Tool Rest: The tool rest for the emery wheel is of a right angle shape passing along the side as well as in front of the wheel, to this rest may be attached the saw gumming attachment which we manufacture.

WHEEL brings out the smooth, keen edge in one-fourth the time required with a bench whetstone. The LEATHER STROPPING WHEEL finishes the edge to perfection. The GRINDING CONE does many odd jobs of internal grinding such as gouges and other tools of irregular shape. The EMERY WHEEL does all general grinding for the shop.

The AUTOMATIC KNIFE-GRINDING ATTACHMENT, which is easily attached or removed, is indispensable for the correct grinding of long knives such as are used in the planer and jointer.

Other machines, such as RADIAL GRINDERS, FACING HEADS, and several additional OILSTONE GRINDERS not described here, are included in the Mummert-Dixon line. We will be pleased to send descriptive literature.

Tool Holder and Table: An adjustable slide table extends across the front of the oilstone wheels. It may be tilted to any angle desired. This table carries a sliding tool holder for holding chisels, plane bits, etc.

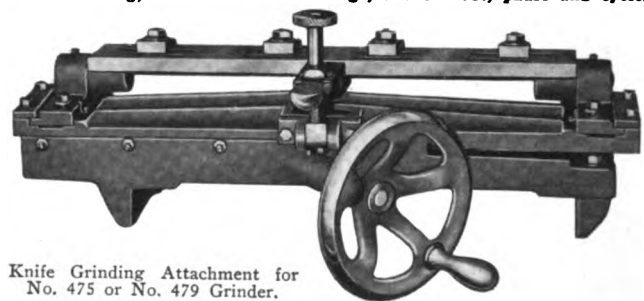
"Safety First." This has been given careful consideration. The emery wheel and spindle end are fully guarded, the leather wheel has a guard on the front side to prevent applying the tool the wrong way. The cone is also amply protected while the oil reservoirs serve as guards for the Oilstone Wheels.

Regular equipment includes one coarse and one fine oilstone wheel, one grinding cone, one grinding wheel, one leather stropping wheel, one tool holder, motor, push-button switch, and cord and plug.

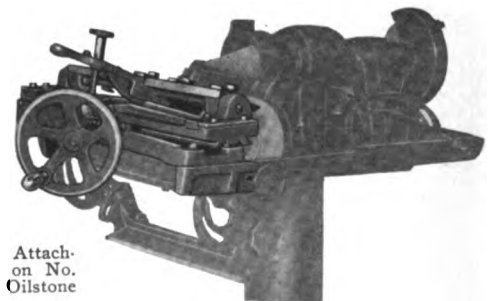
Specifications

Motor Speed	1800 R.P.M.
Speed of Emery Wheel, Cone, and Stropping Wheel.....	1800 R.P.M.
Speed of fine and coarse Oilstone Wheels.....	300 R.P.M.
Size of Emery Wheel.....	8"x 2 1/2"
Size of Oilstone Wheels.....	8"x 2 "
Size of Grinding Cone.....	3"x 5 "
Size of Stropping Wheel.....	5"x 2 "
Overall floor space required.....	26"x36 "
Size of base.....	18"x18 "
Net weight	275 lbs.
Weight crated	325 lbs.

When ordering, be sure to state voltage, and if A.C., phase and cycle.



Knife Grinding Attachment for No. 475 or No. 479 Grinder.



Knife Grinding Attachment in position on No. 475 Plurality Oilstone Grinder.

Knife Grinding Attachment

This hand operated Knife Grinding Attachment may be used with either the No. 475 Plurality Oilstone Tool Grinder or with our older model No. 479. With it, planer, jointer and similar knives up to 24 inches in length may be hollow ground to a perfect edge. With this attachment all the knives in the school shop (up to 24") may be maintained in excellent condition.

The rigid knife bar clamps the knife firmly its entire length and is fixed at any required angle by means of a screw adjustment. Lateral feed is by means of a convenient hand wheel mounted at the front. The entire unit is self-contained and may be attached or dismantled quickly without the use of special tools.

Specifications

Capacity, Length of knives.....	24"	Net weight	130 lbs.
Will grind bevels.....	90° to	Weight, Crated	160 lbs.

Mummert-Dixon Co., Hanover, Pennsylvania

The Parks Woodworking Machine Co.

1505 Knowlton St., Cincinnati, Ohio

Manufacturers of

Woodworking Machinery

Lathes, Saw Machines, Jointers, Mortisers and Sanders

Parks Woodworking Machines have been manufactured for over 35 years. They have always been designed for utmost strength and least possible excess weight. The frame construction is absolutely rigid and vibrationless. We guarantee every Parks machine for 10 years against all defects in material or work-

PARKS

manship. Convenience of operation is another Parks feature which is of particular interest to the manual training teacher and all Parks machines are well guarded and practically fool proof. Write for complete catalog of Parks Woodworking Machines.



"Carpenter Shop Special"

Parks "Carpenter Shop Special"

The Parks "Carpenter Shop Special" is our latest development in combination woodworkers providing more useful units, more convenient arrangement and more space-saving compactness. It is equipped with ball bearings. Has independent drive on every unit.

Includes 18-inch band saw; 9-inch jointer; 16-inch lathe; 10-inch circular saw; hollow chisel mortiser and quick reversible spindle shaper. The circular saw table is a single piece casting planed to a smooth, level finish. Depth of saw cut is adjusted by hand wheel, raising and lowering table. All units are carefully guarded, a feature which is obviously of utmost importance in machines for school use.

9-inch jointer has round safety type cutter head fitted with high speed knives and aluminum jointer guard. Rear plate of jointer has extension for rabbetting. Shaper has reversible spindle driven by a double friction disc. Hollow chisel mortiser is the horizontal type operated by foot lever which moves the mortising table to and from the chisel.

No. A-16 Carpenter Shop Special complete includes one 10-inch rip saw, one 10-inch cross-cut saw, one $\frac{1}{4}$ -inch band saw, one $\frac{3}{8}$ -inch hollow chisel, one $\frac{3}{8}$ -inch boring bit, four belts, equipped with 2 H. P. motor. Price.....\$495.00

Parks "Dixie" Circular Saw Machine

Frame is heavy $1\frac{1}{2}$ -inch angle steel, all joints electric welded. Saw table is one piece casting 19 inches x 36 inches. Ribbed construction, planed to a smooth and accurate surface. Saw table is hinged at the back and raised or lowered by hand wheel and screw elevating device to adjust depth of saw cut. Rip Guide tilts to 45 degrees and can be set for ripping any width up to 8 inches. Cross-cut Guide slides in milled groove and has mitre adjustment to 45 degrees.

No. A-180-M Dixie Circular Saw Machine complete with 1 H. P. Electric Motor, cord, snap switch, plug, one 8-inch rip saw and one 8-inch cross-cut saw. Price.....\$113.00

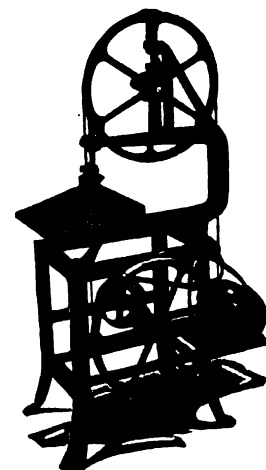
Parks "Jewel" 22-inch Band Saw

The "Jewel" is a splendid 22-inch band saw with $14\frac{1}{2}$ x $17\frac{1}{2}$ -inch table standing 40 inches from the floor, tilted for sawing bevels. Upper wheel has tilting adjustment for tensioning saw against guide.

No. A-62 Jewel 22-inch Band Saw complete with one $\frac{3}{8}$ -inch band saw. Price...\$75.00

No. A-630-M Jewel same with 1 H. P. electric motor. Price\$128.00

Other Parks Band Saws include Rex 18-inch \$60.00 (with motor \$120.00), Century 30-inch Band Saw \$100.00, and Jumbo 36-inch Band Saw \$125.00.



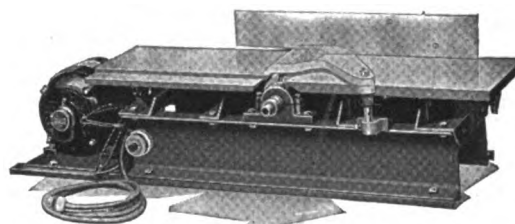
"Jewel" 22" Bandsaw

Parks "Daisy" 6 and 9-inch Jointers

This well built bench jointer has the job done in less time than it takes to clamp the work in a vise for hand planing. Frame is heavy 6-inch channel with angle steel cross bars. Cutter head is the round safety type fitted with three high speed knives. Front and rear plates 18 inches long and rear plate has side extension for rabbetting. Guard is aluminum, operated by spring which keeps it against the guide and over jointer head, being pushed aside only sufficiently to permit the work to move through.

No. A-20 Daisy 6-inch Jointer without motor.....\$60.00
No. A-200-M Daisy 6-inch Jointer with $\frac{1}{2}$ H.P. motor 95.00

No. A-21 Daisy 9-inch Jointer without motor..... 75.00
No. A-210-M Daisy 9-inch Jointer with $\frac{3}{4}$ H.P. motor 118.00



"Daisy" 6" and 9" Jointer

The Parks Woodworking Machine Co., 1505 Knowlton St., Cincinnati, Ohio

Porter-Cable Machine Co.

1919 Park St., Syracuse, N. Y.

Branches: New York—Chicago—Los Angeles—Boston—Cleveland

Since 1906 PORTER-CABLE has been manufacturing machine tools such as Tool Room and Production Lathes and today we enjoy a fine reputation in this field. These tools, of course, must be built with precision and held to the closest measurements. On entering the manufacture of sanding machines over twelve years ago, it naturally followed that these machines should also be built with the same precision and accuracy as machine tools. Such care in manufacturing endows PORTER-CABLE Sanders with long life and consequent low up-keep cost. Today PORTER-CABLE Sanders are the most widely used sanding machines in the world—a fact that proves the practicability of PORTER-CABLE products.

PORTER-CABLE
SANDERS

TAKE-ABOUT Sander



The TAKE-ABOUT Sander speeds up instruction in the shop and makes the work more interesting for the student by eliminating much uninteresting, tedious handsanding and scraping. Snap the switch, let the belt work, you merely guide it. Five to ten times faster than handsanding with a beautiful finish besides. Only a belt can secure a finish without waves or ripple marks. Thousands of woodworkers and schools have adopted the TAKE-ABOUT as standard equipment. Two sizes—TAKE-ABOUT and the SUPER TAKE-ABOUT, one of which you need.

Bench Stand converts the TAKE-ABOUT into an edge sander, a device popular with schools. It is a substantial cast iron supporting frame into which the sander fits when turned on its side allowing the belt to run free. The table of the Bench Stand can be either raised or lowered. Besides tool grinding, it can be used for removing burrs on small wood or metal parts, making the Bench Stand a valuable accessory to the TAKE-ABOUT.



When not being used in the shop, the TAKE-ABOUT pays for itself many times over refinishing desks, tables, seats, etc. It is the only portable sander that can clean slate blackboards, giving them a new appearance. The TAKE-ABOUT pays for itself on this job alone. Low in price and high in returns. For superior sanding—use a Belt Machine.

Combination Belt and Disc Sander-Grinder Type BD-1

Here you have the combined advantages of a belt and disc at a moderate investment. Two students can work at the same time and roughing and finishing can be done without changing the abrasive. The bed of the belt sander can easily be changed to either a horizontal or vertical position as the work requires. This enlarges its capacity and makes it more convenient for certain operations and really provides three machines in one. Runs off light socket. Schools will find it particularly useful for instruction purposes and as a general all-round grinding, sanding, polishing and sharpening machine.



Bench Oscillating Spindle Sander Type O-3 (Patented)



This machine is designed for use in pattern shops, furniture factories and wherever sanding or grinding is necessary on internal and irregular work. Although inexpensive, its capacity for work is tremendous. Its oscillating motion defaces all sand marks and utilizes every bit of sandpaper. Occupies little space and can be operated anywhere within range of a light socket. Primarily an industrial machine, it is, therefore, the machine for instruction purposes. If you desire a larger machine, investigate our Type S-1.

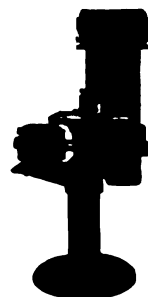
Disc Sander and Grinder Type D-1

This machine, the pioneer of all dustless motor-driven Disc Sanders, has proven by its years of universal service that it is the standard for performance and dependability. Designed for the accurate sanding of segments, angles for built-up work, core prints and circular taper work. Consequently, it is a necessity in pattern work. By use of the angle gauge, graduated in degrees, together with the adjustment for tilting of the table by degrees, absolute accuracy is secured in making compound angles. A new core print gauge makes grinding of core prints, bosses and segments easy. Runs off light socket.



Belt Sander and Grinder Type B-3

For securing a straight grain finish on wood or metal at a minimum investment of capital, this Type B-3 is unequalled. A feature uncommon to sanders of this type is the ability to change the bed from a horizontal to a vertical position or vice versa, thus giving two types of sanders at the cost of one. Takes up little space in the shop and is motor driven. Used extensively by industry for sanding and grinding wood, metal, bakelite, and almost any material. Particularly adapted for sanding boxes, cabinets, chests, drawers, furniture and patterns.



Porter-Cable Machine Co., 1919 Park St., Syracuse, N. Y.

E. H. Sheldon & Company

Muskegon, Michigan

ESTABLISHED 1898

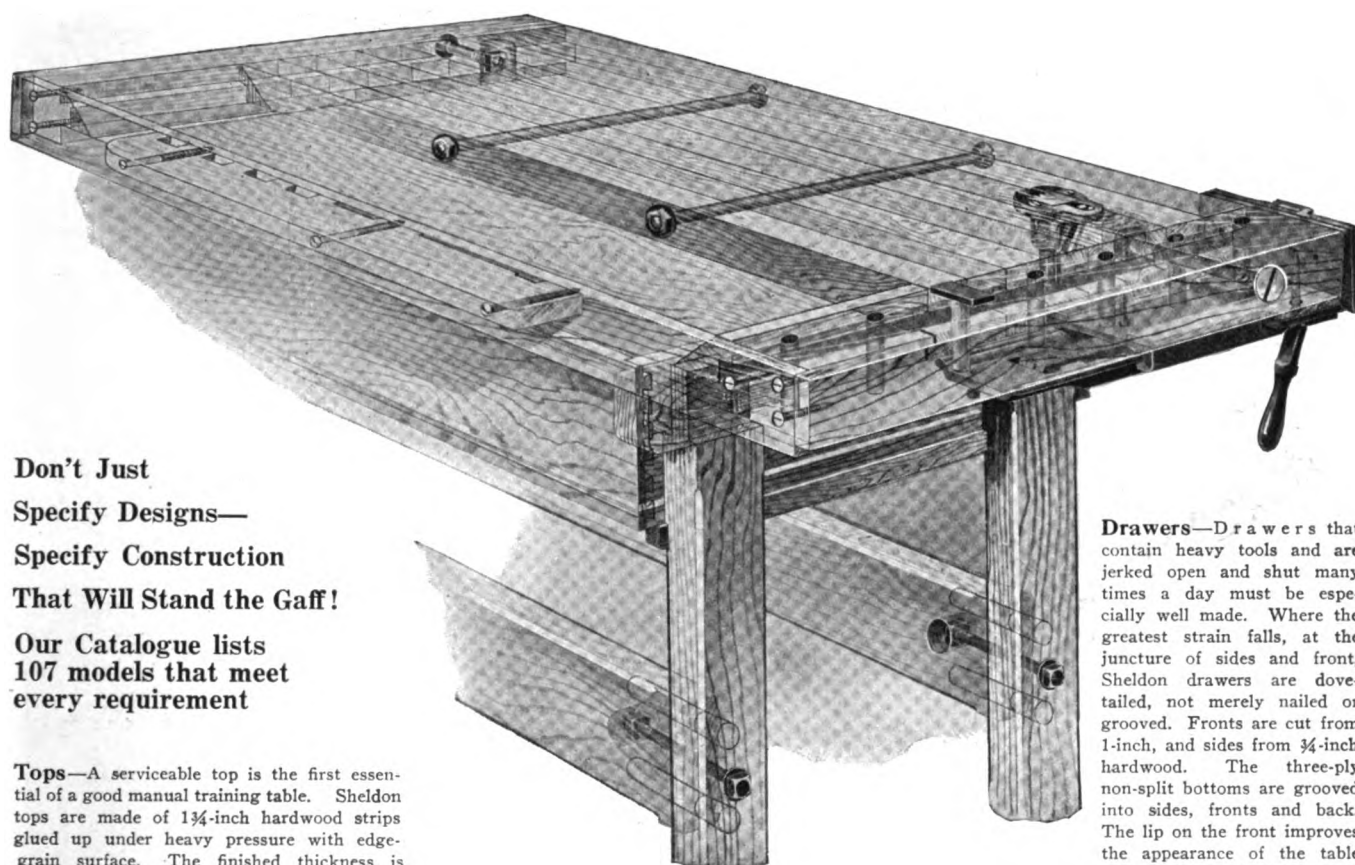
Manufacturers of

Woodworking, Sheet Metal and Home Mechanic's Benches

165,000 Now in Use

Gather together the catalogs of the various manufacturers of work benches and compare the designs offered—the various combinations of drawers and the overall sizes, etc.—you will find duplicates in every catalog. The Sheldon Company builds 45 different benches many of which we originated ourselves during our twenty-eight years in this field—many were originated by school men—none were first made by competitors. Today you will find practically all of these designs offered by the leaders in this industry. The difference is in the construc-

tion! And the usefulness and life of a bench depends fundamentally on how it is constructed. We offer, therefore, for your consideration our construction specifications as set forth in the phantom view and the resumé on this page. Seventy-five thousand Sheldon benches on repeat orders have been sold to the leading educational centers of the country on the basis of Sheldon operating equipment and Sheldon bench construction—convincing evidence that it will pay you to specify Sheldon construction.



Don't Just
Specify Designs—
Specify Construction
That Will Stand the Gaff!

Our Catalogue lists
107 models that meet
every requirement

Tops—A serviceable top is the first essential of a good manual training table. Sheldon tops are made of 1¾-inch hardwood strips glued up under heavy pressure with edge-grain surface. The finished thickness is 2¼ inches or over. Two ½-inch flush-head draw-bolts permanently re-enforce the main section of the top. Heavy bolsters are attached to both ends by deep tongue and groove joints re-enforced by heavy countersunk 5-inch draw-bolts. A tool recess is built into the top as illustrated and a tool rack attached.

Frames—The construction of our open-frame manual training tables is partially shown in the upper picture. Note the deep mortise and tenon glue joints in the stands pinned with hardwood dowels, and the heavy 5-inch girts, or spreaders, attached by ¾-inch dowels and 5-inch draw-bolts. A tool recess is built into the top as illustrated, and a tool rack attached.

Cabinet Benches—Sheldon cabinet or locker manual training tables are characterized by the exceptionally large number of re-enforcing bolts employed in their construction. There are fifteen ½-inch machine bolts in the cabinet section of our locker type table. All material is solid hardwood that has been thoroughly seasoned and kiln-dried, and is protected by our construction methods against shrinking and swelling.

Drawers—Drawers that contain heavy tools and are jerked open and shut many times a day must be especially well made. Where the greatest strain falls, at the juncture of sides and front, Sheldon drawers are dovetailed, not merely nailed or grooved. Fronts are cut from 1-inch, and sides from ¾-inch hardwood. The three-ply non-split bottoms are grooved into sides, fronts and back. The lip on the front improves the appearance of the table and prevents lock picking.

Our method of construction prevents access to one drawer by removing the one above and also prevents the drawer from dropping on the floor when pulled too far out.

Locks—All locks are solid brass and are mortised into the drawer fronts. A ¾-inch key tube is exposed. Locks have brass tumblers and a bolt with a ¾-inch throw guaranteed to withstand 250 pounds pressure without injury. All locks are different, are provided with two German silver double-thick keys, and are fitted for master keys.

Vises—We make our own vises, dogs, stops, etc. We make a rapid acting, continuous screw, and parallel-bar-rapid-acting-vise—165,000 are in use. Sheldon vises are guaranteed unconditionally against defects of material and workmanship. Be sure the vise specified carries a guarantee—protect yourself.

Literature Free. Send today for literature illustrating and describing Sheldon Manual Training Benches and vises for woodworking, sheet metal, home mechanics, electricity, and auto mechanics shops.

E. H. Sheldon & Company, Muskegon, Michigan

The Stanley Rule & Level Plant

Educational Department

New Britain, Conn.

Manufacturers of

Stanley Tools

Useful Reference Books For School Shop Equipment

Stanley Tool Catalog No. 34 with the New School Index

THIS CATALOG illustrates and describes over 1800 different hand tools, the majority of which are intended for woodworking. It contains references, tables and much information regarding replacement parts.

The index has been compiled to help in the selection of tools for the school shop. Based on our experience and study of tools, we recommend the items listed to meet the trying conditions of the school shop.

It is keyed for the work in the Elementary and Junior High School, the Senior High School or Vocational School, and a choice is mentioned on many items.



Stanley Electric Tool Catalog No. S59

THIS handy catalog illustrates and describes in detail the full line of Stanley Electric Tools. You will find that it contains many new items which are particularly adapted for the woodworking, metalworking, automobile and electrical shop.



Stanley-Atha Automotive Tool Catalog No. 26

THIS CATALOG describes a long line of hand tools for use in the automobile shop. Cold Chisels, Punches, Bars, Body & Fender Tools, Screw Drivers, Hammers—a complete line of high quality hand tools.

We shall be glad to send you copies of these catalogs

Stanley Equipment is Standard Equipment

The Stanley Rule & Level Plant, New Britain, Conn.

E. C. Stearns & Company, Inc.

Established 1869

Incorporated 1889

224 Oneida St., Syracuse, N. Y.

Manufacturers of

Clamps and Mechanics Tools

Since 1864 we have been manufacturers of a large and complete line of clamps, but a few of which are described here. In addition we manufacture such mechanics tools as Saw Sets, Saw Vises, Plumb Bobs, and Cement Tools. We originated the Style No. 1 Steel Bar Clamp with the notches on lower side, and since

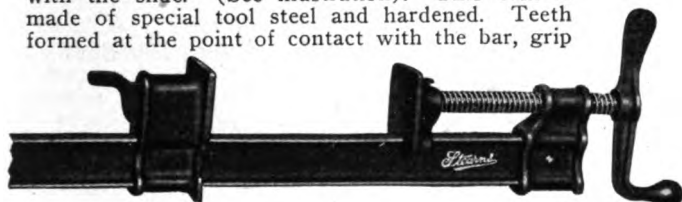


1864 have made continual improvements and many additions. Many years of experience and the constant efforts of a large experimental department have established

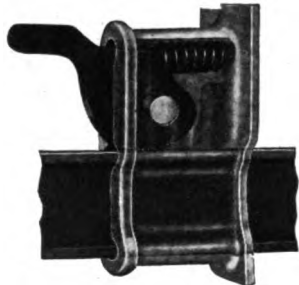
E. C. Stearns & Company as the largest manufacturer of different styles of clamps in the United States.

Stearns Improved "I" Bar Clamp No. 22 (Patent Applied For)

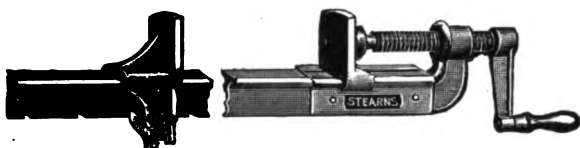
This Clamp, which is the latest addition to our large line of Steel Bar Carpenter's Clamps, has several features not found in any other Clamp. The bar is not notched and therefore has full strength. A special cam locking device is assembled with the slide. (See illustration). This cam is made of special tool steel and hardened. Teeth formed at the point of contact with the bar, grip



it securely yet are instantly released by simply raising the small lever. The holding power of the cam depends directly upon the pressure against the slide, making an ideal, sure-locking device. Fittings are of malleable iron and either metal or wood handle can be furnished. Manufactured in sizes to open 2, 2½, 3, 4, 5, or 6 feet. Larger sizes can also be furnished. Size of bar, 1½x½x½ inches. Size of screw, ½ inches.



Stearns Old Reliable No. 1



Steel Bar Clamp

A remarkably efficient and powerful tool. The "T" shaped bar is rolled from a special quality of steel to give it great strength. The notches on the lower side give added holding power. Steel screw deeply cut thread. Head, crank, jaws and pawls are malleable iron. Sizes give maximum width of work each size will take. Regular Pattern with ¾"x1½" Bar. Open 1, 1½, 2, 2½, 3, 4, 5, or 6 feet. Heavy Pattern with ¾"x1½" Bar. Open 3, 4, 5, 6, 7, 8, 9, or 10 feet.

Stearns Style No. 6 Steel Bar



Carpenter's Clamp
Regular pattern,
with ¾"x1½"
Bar. ½" Screw.

Bars rolled from a special quality of stiff steel. Head, Sliding Jaw, Pawl and Crank of malleable iron. The Steel Screw is provided with a deep and powerful thread. Regular Pattern—Opens 1, 1½, 2, 2½, 3, 4, 5, or 6 feet.

Stearns Style No. 3 Steel Bar

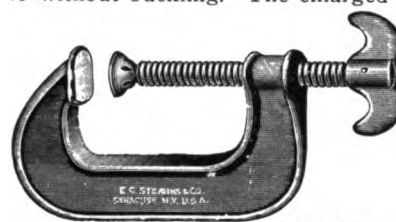
Carpenter's Clamp

Stearns Style No. 3 Steel Bar Carpenter's Clamps. Bar—¾"x1½", ½" screw. Made of extra quality steel, this clamp will not buckle under the strain of work on the job. The steel screw is provided with a deep and powerful thread. Sizes—Open, 1½, 2, 2½, 3, 4, 5, or 6 feet.



Stearns No. 61-A Carriage Makers' Clamp

The Stearns Clamps of all descriptions are so well and favorably known by the trade, having been on the market for so many years, that this needs no introduction other than to say it is the strongest, most durable, Carriage Makers' Clamp on the market. It will stand all usage it might be subject to without buckling. The enlarged steel Screw is provided



with a special thread having great holding power.

The wing is of ample size and shaped to the hand to assure a good grip. To eliminate any chance of wing pulling from the

screw end, it is tapered to fit the end of the screw and then pinned. Furnished with oscillating ball and socket tip which conforms to any beveled surface.

Opening—inches, 2½, 3, 4, 5, 6, 7, 8, 10, 12.

Depth—inches, 1½, 1¾, 1¾, 2¼, 2½, 2¾, 3¾, 3.

(We manufacture both a lighter and heavier pattern clamp and would be glad to furnish folder showing our complete line upon request.)

Stearns Universal Clamp

Every school shop should be equipped with these Universal Clamps for they are ready at a moments notice to do any clamping job that may arise. Simply clamp the screw and tail piece to any convenient 2x4 or other board at any convenient distance apart and you have a powerful clamp "made to order." The two piece outfit takes up very little room in a bench drawer or tool chest. The Head and Tail pieces are high grade malleable iron castings. Screws of steel with deep square threads give great power. Packed in bulk.



No. 32. Up to 1½ inches

in thickness and 2 inches or more in width.

No. 33. Up to 2 inches in thickness and 2 inches or more in width.

Stearns Pistol Grip Saw Set

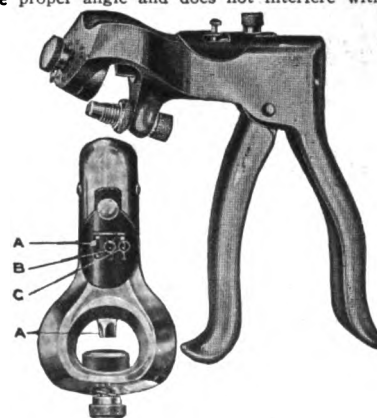
(No. 695 with Oscillating Plunger)

This is the only Saw Set on the market having an oscillating plunger which enables the user to set the plunger to the pitch of the tooth, so that when setting a saw, the plunger comes in contact with the tooth at any other, either ahead or back of the one being set. It is, therefore, possible to set the teeth on both sides alike, thereby clearing the saw equally on both sides and preventing it from cutting or "running" to one side, as the carpenter usually calls it. Simple to operate as there are only three adjustments.

(a) and (c) Slots are used for setting rip saws. (b) Slot used for cross-cut saws.

Hardened anvil and plunger. Finely tempered steel springs.

The catalog of our complete line of Clamps and mechanics' tools should be on your desk. A copy will be sent on request.



E. C. Stearns & Company, Inc., 224 Oneida St., Syracuse, N. Y.

W. C. Toles Company

515 W. Jackson St., Woodstock, Ill.

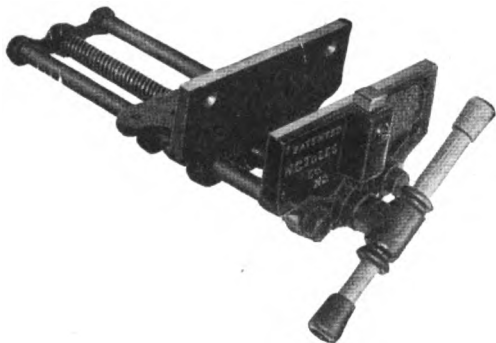
Manufacturers of

Rapid-Acting and Continuous Screw Vises and New Design of Manual Training Benches

The W. C. Toles Company has been engaged in the manufacture of the only genuine Toles Line of Rapid Acting Vises for the past thirty years. This pattern is now the accepted standard for use in schools and is often imitated. The Toles line is now augmented by a complete Junior Line consisting of 7-in. vises. The Junior Line is so constructed that the Rapid Acting vises may be quickly and easily changed to Continuous Screw Action and vice versa. The simplicity of this unique convertible feature enables a novice to make the change in a few minutes when supplied with the necessary parts.

Features of Toles Vises

All castings are made from our own formula metal and are tested for strength, durability and sturdiness. Faces and edges of jaws are ground smooth. The screws used in both rapid acting and continuous screw vises are 1 1/4-in. diameter and the double Acme thread is engaged in a bronze nut. Rigidity and durability is assured by over size guide rods of 3/4-in. round steel. Wood handles are of straight grained hickory and are weighted at one end. Where dogs are specified, they are of brass 1 in. square. A coil spring forces them upward and they may be fastened at any height by means of set screws.



Toles Rapid Acting Vise No. 45

Rapid Acting Vises (Iron Faced)

	Length Jaw	Depth Jaw	Standard Opening	Features	Wts.
No. 20	10 in.	4 in.	12 in.	No Jaw Dog or Bench Stop..	36 lbs.
No. 25	10 in.	4 in.	12 in.	Bench Stop Only.....	38 lbs.
No. 40	10 in.	4 in.	12 in.	Bench Stop and Jaw Dog.....	39 lbs.
No. 45	10 in.	4 in.	12 in.	Front Jaw Dog Only.....	37 lbs.

Rapid Acting Vises (Wood Faced)

	Length Jaw	Depth Jaw	Standard Opening	Features	Wts.
No. 50	10 in.	4 1/2 in.	12 in.	No Outer Jaw Dog or Bench Stop.....	39 lbs.
No. 55	10 in.	4 1/2 in.	12 in.	Bench Stop only.....	39 lbs.
No. 60	10 in.	4 1/2 in.	12 in.	Outer Jaw Dog only.....	39 lbs.
No. 65	10 in.	4 1/2 in.	12 in.	Bench Stop and Front Jaw Dog	41 lbs.

No. 35 Rapid Acting Tail Vise

This is a design of rapid acting tail vise. The length of Jaws is 6 in., the depth 3 1/2 in., and it has a brass dog 1 in. square incorporated in the front jaw. This vise can be supplied in various size openings, 6, 8, 10, and 12 in. The 6-in. opening is our standard, and will be shipped unless others are specified. The jaws are ground but not maple faced.

Wt.
30 lbs.

Toles' Junior Vises

No. 5-FD and No. 10-FD Juniors—either action—may be had in 8"x4" jaws, listing extra, or 7"x4" jaws, listing extra.

The Junior Line consists of eight different numbers. The identical construction features of the regular Toles Vises are incorporated in this line. The same standard of manufacture has been maintained throughout, supplying a demand for an inexpensive vise of quality that is especially adapted for use in schools, of Elementary and Junior High Grade.

Rapid Acting Toles Junior Vises

	Length Jaw	Depth Jaw	Standard Opening	Features	Wts.
No. 5	7"	3"	9"	Front & inner jaw. No stop dogs..	23 lbs.
No. 5-F.D.	7"	3"	9"	Front & inner jaw. Dog in front jaw only.....	24 lbs.
No. 5-B.D.	7"	3"	9"	Front & inner jaw. Dog in inner jaw only.....	25 lbs.
No. 5-2-D.	7"	3"	9"	Front & inner jaw. Dog in both jaws	26 lbs.

Continuous Screw Toles Junior Vises

	Length Jaw	Depth Jaw	Standard Opening	Features	Wts.
No. 10	7"	3"	9"	Front & inner jaw. No stop dogs..	23 lbs.
No. 10-F.D.	7"	3"	9"	Front & inner jaw. Dog in front jaw only.....	24 lbs.
No. 10-B.D.	7"	3"	9"	Front & inner jaw. Dog in inner jaw only.....	25 lbs.
No. 10-2-D.	7"	3"	9"	Front & inner jaw. Dog in both Jaws	26 lbs.

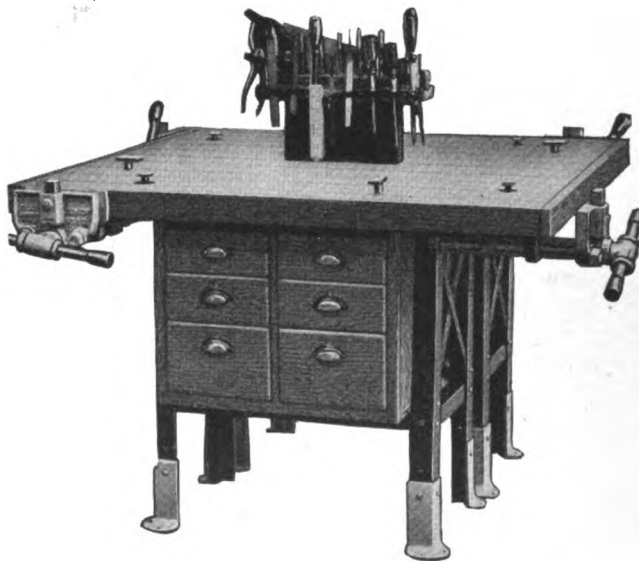
All are convertible to Rapid Acting Vises. Have solid nut of navy bronze, machined, floating with screw.

Toles "Spasaver" Manual Training Benches

These new design benches afford features of adjustability, flexibility and economy of space not found in other benches.

Adjustment of Height—This new and valuable feature provides a simple means of adjusting the height of the work table to suit the worker. Anyone of three heights may be had by changing the foot adjustment bolts to various holes provided in the legs. Two ranges are available, viz.—Selective at 34 in.,—32 in. or 30 in.; at 32 in.—30 in. or 28 in.

Economy of Space—One bench normally accommodates one boy. Two benches placed back to back and bolted together provide ample, unrestricted working area for four boys.



Two Toles SPASAVER Benches Bolted Together

The twin arrangement of Toles SPASAVER Benches is provided for in their design, and bolts for drawing together and securely fastening two benches are part of the standard equipment.

General—Material and workmanship are of the highest order and the benches are rigid, sturdy and attractive. Regular equipment for each single bench includes two Toles Junior Vises No. 5 F.D., but any other Toles vises are optional, with price regulated to equalize. Two Toles adjustable bench stops and two Toles movable bench dogs are standard. Benches may have drawers or be of the open frame style. A good selection of table top sizes is available.

We invite your further correspondence.

W. C. Toles Company, 515 W. Jackson St., Woodstock, Ill.

W. M. Welch Manufacturing Company

Laboratory Furniture Factory
Manitowoc, Wisconsin, U. S. A.

General Office and Scientific Apparatus Factory
1516 Orleans St., Chicago, U. S. A.

Manufacturers of Laboratory, Vocational, Library Furniture, Apparatus and Supplies
Sales Representatives in Principal Cities

Manual Training Benches

All lumber used in WELCH furniture is carefully selected and carefully dried in Vapor Kilns, to assure our clients of high-grade materials, which, with good workmanship, insures long and satisfactory service.

The following specifications apply to all Manual Training benches listed below, except where otherwise noted.

Wood tops are of Northern-grown hard Maple strips, $2\frac{3}{4}$ " thick, joined with double tongue and groove construction. This joint increases the gluing surface greatly, and also compels the use of more lumber in the top. It has been found that the added strength justifies this method of construction.

The tops are further safeguarded by the use of bolsters, which are tenoned, glued and bolted (not screwed) across the ends.

Wood frames are of full mortise and tenon construction, reinforced with machine bolts, insuring absolute rigidity. The metal leg units are of steel with welded cross and longitudinal bracing. Flared feet provide ample contact with the floor.

Drawers are of tenon and groove construction, front and

back, the sides, front and back are grooved on the inside to receive 3-ply laminated bottoms, resulting in the full framed-in drawers, which prevents the bottom from working out, and also holds the drawer square at all times. Drawers have full lap construction. Partitions are provided between the drawers to prevent pupils from getting into any drawers but their own, and also makes the drawer compartments dust-proof. All drawers are varnished on the inside.

All wood parts of benches are finished natural. Metal leg units are finished Olive Green baked enamel.

When locks are called for, we use extra heavy cast brass cylinder five-tumbler locks as manufactured by the Yale & Towne Manufacturing company of Stamford, Connecticut. These locks are all different and are furnished with two keys each. Masterkeying can be had at a small additional charge.

Benches are regularly equipped with quick-action, rapid-thread vises and bench dog and stop.

All materials being carefully selected and carefully assembled, insures a quality article, with rigidity, simplicity and adaptability as the major items of consideration.



Top measures 52" long, 36" wide, and bench is 32" high. Tool recess is 7" wide, furnished in the center of the desk.

Bench is furnished with rapid-thread, quick-action vise.

- No. 9850—As illustrated.....shpg. wt. 250 lbs.
No. 9852—Same as No. 9850, but with one drawer on each side measuring $30\frac{3}{4}$ " wide, $14\frac{3}{4}$ " front to back and 5" deep, inside dimensions, WITHOUT LOCKS.....shpg. wt. 270 lbs.
No. 9853—Same as No. 9852, but WITH LOCKS.....shpg. wt. 270 lbs.
No. 9750—Similar to No. 9850, with wood base instead of steel legs, but without drawers.....shpg. wt. 200 lbs.
No. 9752—As illustrated, with wood base, with one drawer in each side, WITHOUT LOCKS.....shpg. wt. 220 lbs.
No. 9753—Same as No. 9752, but WITH LOCKS.....shpg. wt. 220 lbs.

No. 9758 Double Manual Training Bench



Top measures 52" long, 36" wide, and the bench is 32" high. Tool recess is 7" wide, in the center in the desk. One large drawer measures $30\frac{3}{4}$ " wide, $14\frac{3}{4}$ " front to back and 5" deep, inside measurements. (One large drawer in each side of bench.) Six individual drawers in each side (12 in all), measure $14\frac{1}{2}$ " wide, $14\frac{3}{4}$ " front to back, and 5" deep, inside measurements. Ends of the bench are paneled.

- Bench is furnished with rapid-thread, quick-action vise with dog, also with stops.
No. 9758—As illustrated, WITHOUT LOCKS.....shpg. wt. 400 lbs.
No. 9759—Same as No. 9758, but WITH LOCKS ON THE SMALL DRAWERS ONLY.....shpg. wt. 400 lbs.
No. 9760—As illustrated, with six large drawers, three on each side, measuring $30\frac{3}{4}$ " wide, $14\frac{3}{4}$ " front to back and 5" deep, WITHOUT LOCKS.....shpg. wt. 320 lbs.
No. 9761—Same as No. 9760, but WITH LOCKS.....shpg. wt. 320 lbs.

No. 9712 Single Manual Training Bench



Top measures 52" long, 22" wide and is 32" high. Tool recess is 7" wide and is complete with tool rack at rear. One large drawer measures $30\frac{3}{4}$ " wide, $14\frac{3}{4}$ " front to back and 5" deep, inside measurements. Four individual smaller drawers measure $14\frac{1}{2}$ " wide, $14\frac{3}{4}$ " front to back and 5" deep, inside measurements. Bench is furnished with rapid-thread, quick-action vise with dog.

- No. 9712—As illustrated, WITHOUT LOCKS.....shpg. wt. 230 lbs.
No. 9713—Same as No. 9712, but WITH LOCKS ON THE SMALL DRAWERS ONLY.....shpg. wt. 230 lbs.

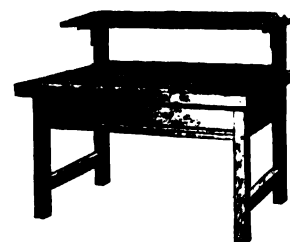
No. 9804 Single Manual Training Bench



Top measures 52" long, 22" wide and the bench is 30" high. Tool recess is 7" wide and is complete with tool rack at rear. Drawer measures $30\frac{3}{4}$ " wide, $14\frac{3}{4}$ " front to back and 5" deep, inside measurements. Bench is furnished with rapid-thread, quick-action vise with dog. Bench may be had with metal or wood base.

- No. 9804—As illustrated, WITHOUT LOCKS.....shpg. wt. 180 lbs.
No. 9805—Same as No. 9804, but WITH LOCKS.....shpg. wt. 180 lbs.
No. 9700—Wood base, without drawer, as illustrated.....shpg. wt. 150 lbs.
No. 9704—Similar to No. 9700, but with one drawer, WITHOUT LOCK.....shpg. wt. 160 lbs.
No. 9705—Same as No. 9704 but WITH LOCK.....shpg. wt. 160 lbs.

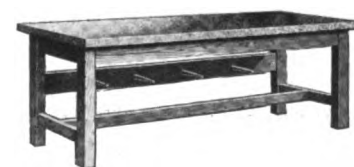
No. 9739 Stain Bench



Bench is 27" wide, 54" long and 32" high. Body of selected Oak, top of Birch or Maple, $2\frac{3}{4}$ " thick built up of slats, with $\frac{3}{4}$ " openings between each slat, reinforced with $3\frac{3}{4}$ " side pieces. Shelf above top measures 7" wide and 54" long, and has retaining rim or rail at back and ends. Bench is equipped with galvanized iron drip pan.

- No. 9739—As illustrated.....shpg. wt. 220 lbs.

No. 9737 Glue Bench



Bench is 24" wide, 72" long, and is 32" high, provided with four wood pegs at the rear for hand screw clamps. Built of selected Oak, natural finish. Top is covered with galvanized iron.

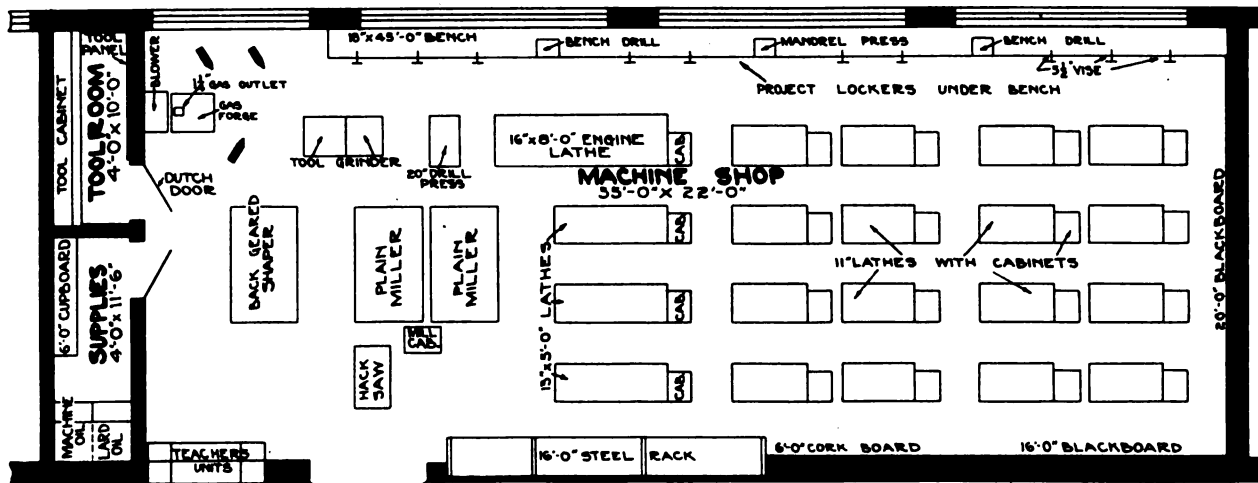
- No. 9737—As illustrated.....shpg. wt. 260 lbs.

Refer to Welch Specifications in the Drafting Section

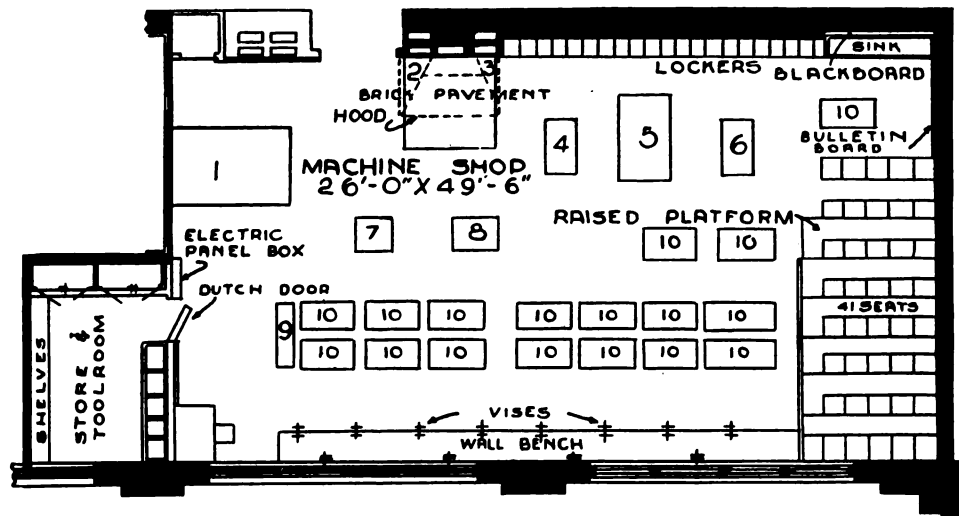
W. M. Welch Manufacturing Company, 1516 Orleans St., Chicago, Ill., Factory, Manitowoc, Wis.

Metal-Working Shop Layouts

For outline of metal-working courses, see page 256
For equipment and supply list, see page 148

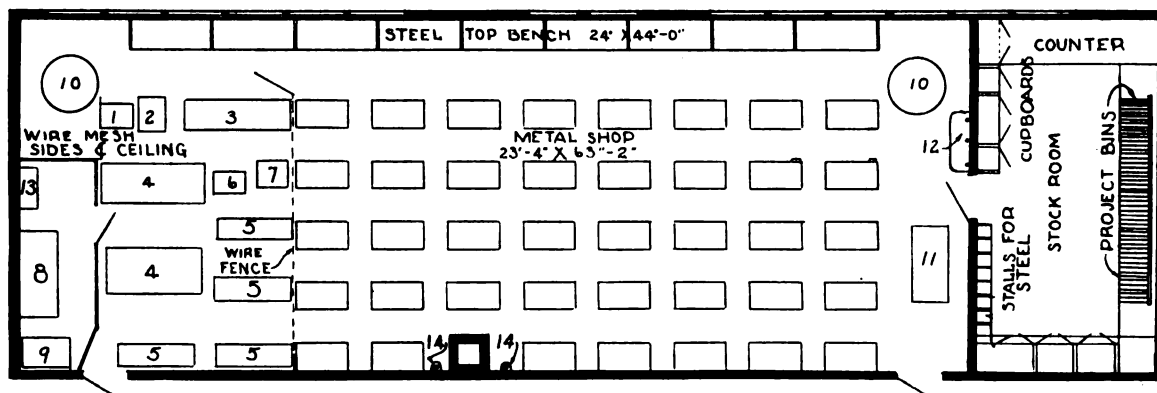


JUNIOR HIGH SCHOOL, HAMTRAMCK, MICH.



MACHINE SHOP, TAPPAN INTERMEDIATE SCHOOL, DETROIT, MICH.

- | | | |
|------------------------|----------------------|--------------------|
| 1. Milling Machine | 4. Shaper | 8. Sensitive Drill |
| 2. Tool Dressing Forge | 5. Universal Grinder | 9. Hack Saw |
| 3. Soft Metal Furnace | 6. Drill Press | 10. Engine Lathe |
| | 7. Tool Grinder | |



METAL SHOP, JUNIOR HIGH SCHOOL, MILWAUKEE, WIS.

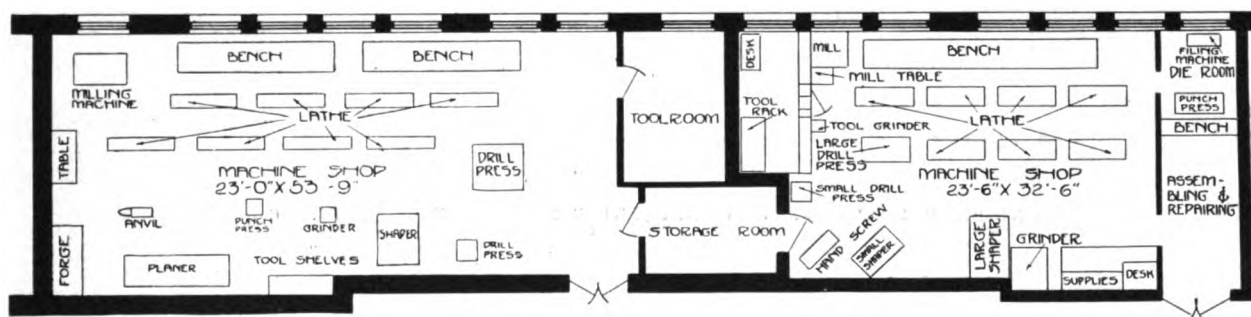
- | | | |
|---------------------------|----------------------|-----------------------|
| 1. Forge | 6. Drill Press | 11. Desk |
| 2. Anvil | 7. Grinder | 12. Sink |
| 3. Table for Speed Drills | 8. Switchboard | 13. Holzer Cabot Unit |
| 4. Engine Lathes | 9. Kohler Cabot Unit | 14. Glue Pots |
| 5. Lathe | 10. Stoves | |



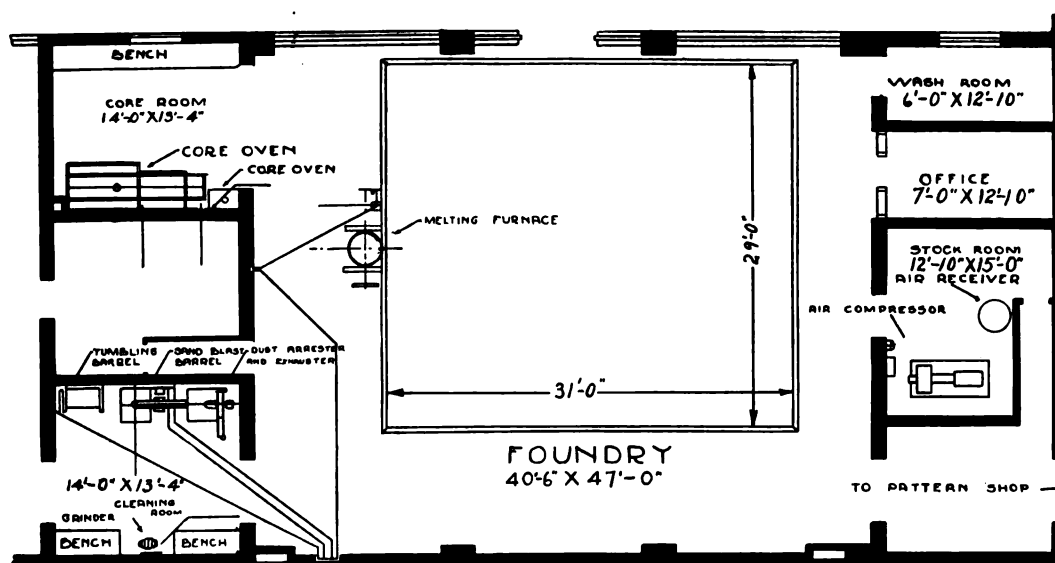
- | | | |
|---------------------|---------------|--------------------|
| 1. Toolroom | 5. 13" Lathes | 9. Benches |
| 2. Teacher's Office | 6. 9" Lathes | 10. Switchboard |
| 3. Drill Press | 7. Hack Saw | 11. Cabinet |
| 4. Shaper | 8. Forge | 12. Bulletin Board |



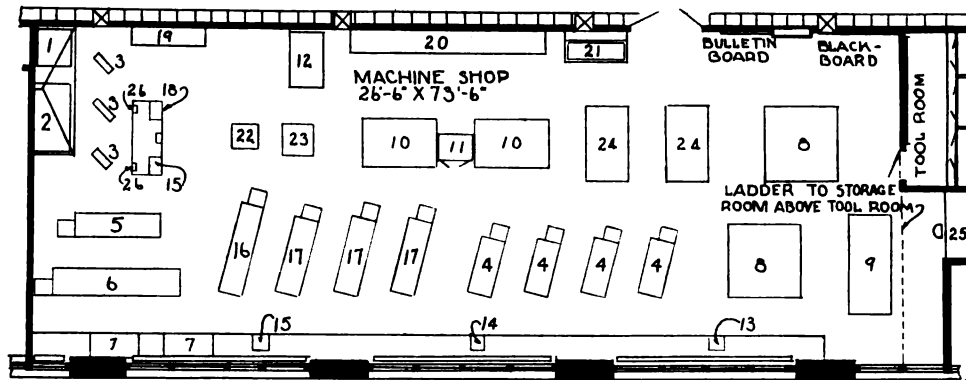
GENERAL METAL SHOP, JUNIOR HIGH SCHOOL,
PHILADELPHIA, PA.



MACHINE SHOP, J. STERLING MORTON HIGH SCHOOL, CICERO, ILLINOIS

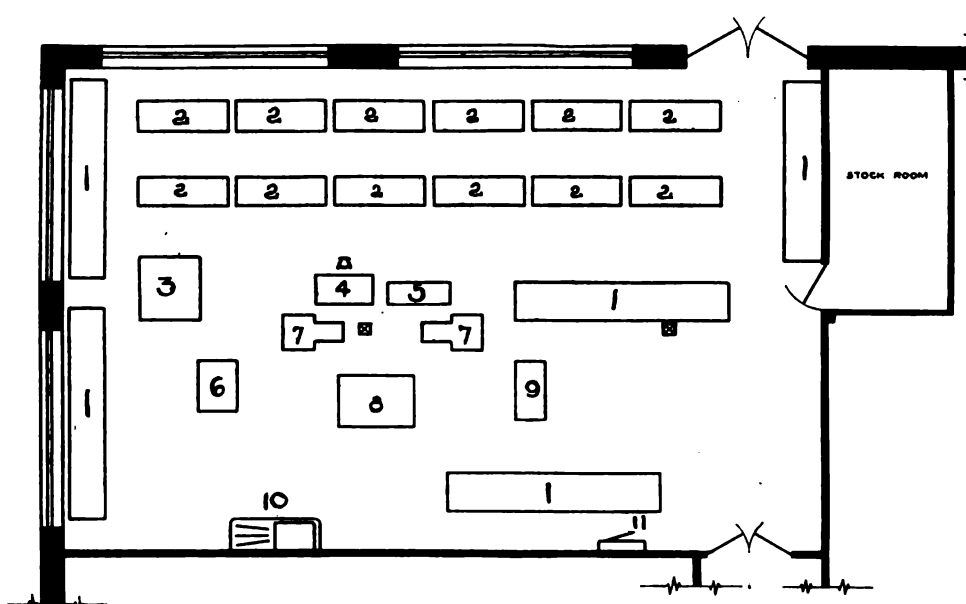


FOUNDRY, JOHN HARRIS HIGH SCHOOL, HARRISBURG, PA.



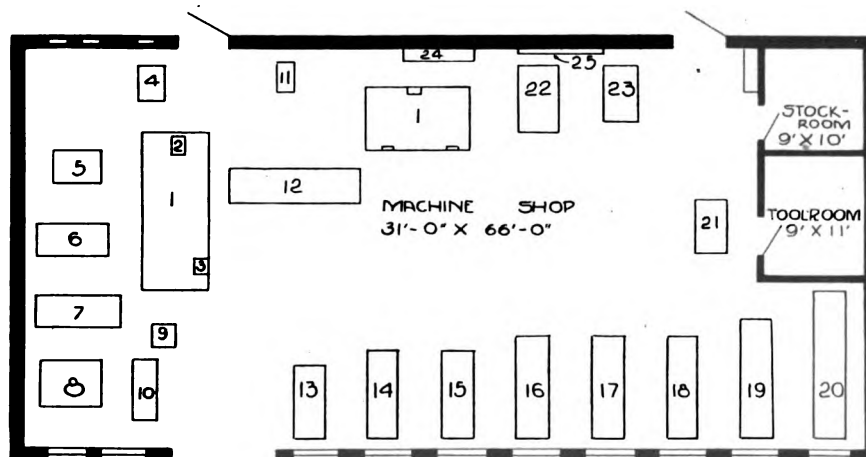
MACHINE SHOP, PONTIAC HIGH SCHOOL, PONTIAC, MICH.

- | | | |
|----------------------|---------------------------------------------|---------------------|
| 1. Gas Forge | 10. Millers | 18. Bench Grinder |
| 2. Tempering Furnace | 11. Cabinet for Storage of Miller Equipment | 19. Steel Cabinet |
| 3. Anvils | 12. Hack Saw | 20. Stock Rack |
| 4. Lathes | 13. Bench Grinder | 21. Sink |
| 5. 15" x 7' Lathe | 14. Bench Drill | 22. Sensitive Drill |
| 6. 18" x 10' Lathe | 15. Bench Mandrel Press | 23. Drill Press |
| 7. 9" Bench Lathes | 16. 14" Lathe | 24. Shaper |
| 8. Grinder | 17. 13" Lathe | 25. Unit Case |
| 9. Planer | | 26. Vises |



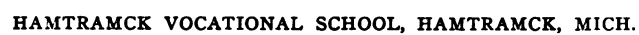
MACHINE SHOP, FOREST PARK JUNIOR-SENIOR HIGH SCHOOL, BALTIMORE, MD.

- | | | |
|--------------------|----------------|----------------|
| 1. Vise Bench | 5. Bench | 9. Power Saw |
| 2. Lathes | 6. Dry Grinder | 10. Sink |
| 3. Milling Machine | 7. Drill Press | 11. Switch Box |
| 4. Desk | 8. Shaper | |



MACHINE SHOP, JOHN MUIR TECHNICAL HIGH SCHOOL, PASADENA, CALIF.

- | | | |
|--------------------------|---------------------|---------------------------|
| 1. Workbench | 9. Cutter Grinder | 18. 14" x 6' Lathe |
| 2. Arbor Press | 10. Forge | 19. 16" x 8' Lathe |
| 3. Speed Drill | 11. Power Hack Saw | 20. 18" x 10' Lathe |
| 4. Tool Grinder | 12. 24" x 6' Planer | 21. Desk |
| 5. 20" Drill Press | 13. 9" x 4' Lathe | 22. 16" Heavy-Duty Shaper |
| 6. 11" x 5' Fall Lathe | 14. 11" x 5' Lathe | 23. Milling Machine |
| 7. 14" x 6' Lathe | 15. 11" x 5' Lathe | 24. Tool Cabinet |
| 8. Heat-Treating Furnace | 16. 12" x 6' Lathe | 25. 7" x 6' Switchboard |
| | 17. 12" x 6' Lathe | |



Metal-Working Equipment

Major Equipment

20 to 25 Students Per Class

Name and Description	Elementary School	Junior High School	Senior High School	Technical High and Full-Time Vocational Schools	Part-Time Vocational School
Air Compressors , for machine shop, foundry, or forge shop			As required		
Anvil , 100-lb.			1 or more as required		
Arbor Press , bench or pedestal type	0	1	1	2	1
Barrows					
Coke	0	0	1	2	1
Foundry	0	0	1	2	1
Scrap	0	1	1	2	1
Belt Lacer	0	1	1	1	1
Benches					
Coremaking			1 or more as required		
For metal working, iron or steel legs. Tops metal or hardwood lumber 1¾ to 2½ in. thick.....			1 or more as required		
Molding			1 or more as required		
Blackboard					
Permanent or portable.....			1 or more		
Blowers , for furnaces, forges, etc.			As required		
Blowtorch , 1-qt. size.....	1	1	1	1	1
Bookcase					
For reference books, catalogs, etc.			1 or more as required		
Boring Bar	0	0	1	2	1
Boring Mill , vertical or horizontal	0	0	0	1	0
Bulletin Board			1 or more		
Cabinets , wood or metal, for filing class records, instruction sheets, drawings, etc., or for tools and supplies.....			1 or more as required		
Casehardening Boxes	0	0	2	4	2
Centering Machine	0	0	1	1	1
Chain Hoists , differential, duplex or triplex.....			1 or more as required		
Chairs , tablet-arm if needed for related-subjects room, or demonstration section.....	25	25	25	25	25
Chuck					
Drill, selected sizes, each...	1	1	2	2	2
Lathe, combination, 4-jaw, selected sizes, each.....	0	1	1	2	1
Lathe, independent, 4-jaw, selected sizes, each.....	0	1	1	2	1
Lathe, universal 3-jaw, selected sizes, each.....	0	1	1	2	1
Milling machine, universal..	0	0	1	2	1
Core Oven , for foundry.....	0	0	1	2	2
Cranes and Hoists , air, electric or hand, of the jib, traveling, or portable type.....			As required		
Cupola , for foundry, coke or electric, ¼ to 1-ton capacity.	0	0	1 or more as required		

See classified directory for sources of supply

Name and Description	Elementary School	Junior High School	Senior High School	Technical High and Full-Time Vocational Schools	Part-Time Vocational School
Desk					
Teacher's, with drawer compartments	1	1	1	1	1
Chair, to match desk	1	1	1	1	1
Die-Filing Machine	0	0	0	1	0
Dividing Head	0	1	2	3	2
Drill					
Bench, hand	1	3	0	0	0
Breast	1	1	1	1	1
Electric, portable	0	1	1	2	1
Hand	3	3	3	3	3
Post, hand or power	1	2	0	0	0
Radial	0	0	1	1	1
Sensitive	0	0	1	1	1
Upright, power	0	1	2	3	2
Flasks, 2 or 3 part, steel or snap type	0	0	As required		
Forge, coal or gas, with hand- or electric-driven blower....			1 or more as required		
Furnaces					
Annealing	0	0	1	1	1
Bench	1	2	2	2	2
Brass and soft metal	0	0	1	1	1
Combination bench	1	1	1	1	1
Casehardening	0	0	0	1	1
Cyanide	0	0	0	1	0
Gasoline	0	1	1	1	1
Heat treating	0	0	1	1	1
Melting	1	1	1	1	1
Gear-Cutting Machine	0	0	0	1	0
Grinder					
Bench, hand or power driven	1	1	1	1	1
Combination grinder, buffer and polisher	0	1	1	1	1
Emery, bench or pedestal type	0	1	1	1	1
Face, with magnetic chuck..	0	0	1	1	1
Portable tool post	0	0	1	1	1
Precision, for external and internal grinding	0	0	0	1	0
Universal tool-cutter, drill and reamer grinder	0	0	0	1	1
Wet tool	0	0	0	1	1
Hand Picks, for cleaning inside of cupola, 1¼ to 2½ pounds	0	0	1	1	1
Hack Saw, power or belt driven	0	1	1	1	1
Hardness Testing Machine....	0	0	1	1	1
Lathes, belt or individual drives					
Automatic	0	0	0	1	0
Bench, 6" to 11" swing, 11" to 36" between centers....	0	4	4	4	4
Change gear, 9" to 14" swing, 18" to 36" between centers	0	4	4	4	4
Quick-change gear, 9" to 16" swing, 18" to 36" between centers	0	1	1	2	2
Semiquick-change gear, 9" to 18" swing, 18" to 42" between centers	0	1	1	4	4
Turret	0	0	1	2	1
Milling Machine					
Plain, cone or motor-driven type	0	1	1	3	2
Universal, cone or motor-driven type	0	0	1	2	1
Nibbling Machine	0	0	0	1	0
Pipe Cutter	0	1	1	1	1

Use post-card service for special information

Name and Description	Elementary School	Junior High School	Senior High School	Technical High and Full-Time Vocational Schools	Part-Time Vocational School
Planer, belt or motor driven..	0	1	1	2	1
Power Hammer, for forging operations	0	0	0	1	0
Punches, metal, hand or power	1	1	1	1	1
Pyrometer	0	0	1	1	1
Pyroscope	0	0	0	1	0
Relieving attachment for Lathe	0	0	1	1	1
Sandblast Outfit, with cabinet.	0	0	1	1	1
Sand Sifter, for foundry, hand or power	0	0	1	1	1
Scale					
Counter, for machine shop..	0	1	1	1	1
Platform, for foundry, 1000-lb. capacity	0	0	1	1	1
Shaper	0	1	2	4	4
Slotter	0	0	0	1	0
Snap-Flask Jackets, to fit snap flasks used	0	0	24	48	48
Straightening Press	0	0	1	1	1
Surface Plates	0	1	1	2	1
Swage Block and Stand, for forge shop	0	1	1	1	1
Taper Attachment for Lathe..	0	1	3	6	3
Truck, warehouse	0	1	1	1	1
Tumbling barrel, for the foundry	0	0	1	1	1
Vises					
Blacksmith	0	1	1	1	1
Drill press	0	0	1	1	1
Machinist	0	12	12	12	12
Pipe	0	1	1	1	1
Planer	0	0	1	1	1
Shaper	0	0	1	1	1
Welding Outfit					
Acetylene	0	0	1	4	3
Electric	0	0	0	1	0

Metal-Working Equipment

Small Tools

20 to 25 Students Per Class

Name and Description	Elementary School	Junior High School	Senior High School	Technical High and Full-Time Vocational Schools.	Part-Time Vocational School
Arbors					
Drill chuck to suit requirements	2	4	4	6	4
Reamers, various sizes, each	0	1	1	2	1
Shell tool, various sizes, each	0	1	1	2	1
Straight shank for shell reamers and shell drills, selected sizes, each.....	0	1	1	2	1
Taper shank for shell reamers and shell drills, selected sizes, each.....	0	1	1	2	1
Bearing Scraper, sets	0	1	2	2	2

See classified directory for sources of supply

Name and Description	Elementary School	Junior High School	Senior High School	Technical High and Full-Time Vocational Schools	Part-Time Vocational School
Bellows, for foundry class....	0	0	12	24	12
Bevel Protractor	0	0	1	3	1
Brooms and Floor Brushes, for shop and foundry.....	4	4	4	4	4
Brushes					
Bench	12	12	12	12	12
Core box.....			As required		
Core painting.....			As required		
Hard brushes for the foundry			As required		
Soft brushes for the foundry	0	0	10	15	10
Bulb Sponges, for molders....	0	0	10	15	10
Draw Pins, for molders.....	0	0	10	15	10
Calipers					
Hermaphrodite, 4".....	0	4	4	6	4
Hermaphrodite, 6".....	0	2	2	3	2
Inside, 4".....	2	4	6	6	6
Inside, 6".....	1	2	3	3	3
Outside, 4".....	3	6	12	12	12
Outside, 6".....	1	2	3	3	3
Cans					
Oil, ½-pt.....	3	6	8	12	8
Oil, 1-pt.....	1	2	2	3	2
Oil, 10-gal.....	1	1	1	1	1
Waste	1	2	2	2	2
Center Testers	0	1	1	2	1
Chisels					
Cape, ⅜" and ⅝", each....	2	2	3	4	3
Cold, ⅝" and ¾", each....	2	2	3	4	3
Diamond point, ⅜" and ½", each	1	1	2	3	2
Round nose, ⅜" and ½", each	2	2	3	4	3
Clamps, 4" and 6", each.....	4	4	4	6	4
8" and 10", each.....	0	2	4	6	4
Flask, for the foundry.....			As required		
Strap, various sizes, each...	0	6	6	12	6
Coke Forks, for foundry.....	0	0	1	2	2
Collets					
For milling machine, selected sizes, each	0	1	1	1	1
For lathe, selected sizes, each	0	1	1	1	1
Combination Squares, with hardened head and blade, and protractor head, 9" and 12", each	0	2	3	4	3
Counterbores, straight and tapered chanks, selected sizes, each	0	1	1	2	1
Countersinks, for metal.....	3	4	4	4	4
Crucibles, of suitable sizes, each	0	0	6	6	6
Shanks, single, end to fit ladles	0	0	3	3	3
Shanks, hand, to fit ladle bowls	0	0	3	3	3
Crucible Tongs, to fit crucibles, each	0	0	1	2	2
Cutters					
Angular-milling			1 or more as required		
Bevel-gear			1 or more as required		
Concave-milling			1 or more as required		
Convex-milling			1 or more as required		
End-milling			1 or more as required		
Face-milling			1 or more as required		
Formed-milling			1 or more as required		
Grooving			1 or more as required		
Involute gear teeth.....			1 or more as required		
Key-seat			1 or more as required		
Side-milling			1 or more as required		
Metal-slitting			1 or more as required		

Use post-card service for special information

Name and Description	Elementary School	Junior High School	Senior High School	Technical High and Full-Time Vocational Schools	Part-Time Vocational School
Dividers					
Spring, 4".....	2	3	4	4	4
Spring, 6".....	2	3	4	4	4
Drill					
Drifts, different sizes, each..	0	1	2	2	2
Drill sleeves, different sizes, each	0	1	2	3	2
Stand for Nos. 1 to 60.....	0	1	1	1	1
Stand for $\frac{1}{8}$ " to $\frac{1}{2}$ " by 64ths	0	1	1	1	1
Drills					
Center	0	6	6	6	6
High-speed, taper shank, various sizes, each.....	0	2	2	2	2
Jobbers, straight shank, $\frac{1}{8}$ " to $\frac{1}{2}$ " by 64ths, each.....	3	6	12	12	12
Ratchet	0	0	1	1	1
Straight-shank, Nos. 1 to 60, each	0	3	6	6	6
Taper shank, $\frac{1}{2}$ " to 1" by 16ths, each.....	0	2	3	3	3
Emery					
Rub-stones for cleaning castings in the foundry.....	0	0	6	6	6
File Card.....	3	6	6	6	6
Files					
Die sinkers, various shapes, each	0	0	0	3	0
Flat bastard, 8" and 10", each	12	12	12	12	12
Half-round, double cut, 6", 8", and 10", each.....	3	6	6	12	6
Hand, smooth, 8" and 10", each	0	0	3	6	3
Mill, smooth, 8" and 10", each	0	0	3	6	3
Round bastard, 8".....	12	12	12	12	12
Square bastard, 8".....	12	12	12	12	12
Swiss, various shapes, each.....	0	0	0	6	0
Three-square, double cut, 6".....	0	0	3	6	3
Warding, double cut, 6".....	3	3	6	6	6
First-Aid Cabinet and Supplies	1	1	1	1	1
Forge Tools					
Drift pins, flatters, fullers, hand and handle punches, hardies, hot and cold cutters, set hammers, and swages for the forge shop.			As required		
Gate Sticks, maple, for foundry	0	0	12	12	12
Gauges					
Center	0	3	6	6	6
Depth	0	1	2	4	2
Drill and wire.....	0	1	1	1	1
Screw pitch, select kinds, each	0	1	1	1	1
Surface	0	1	2	4	2
Gloves, asbestos, for foundry			As required		
Goggles					
For machine shop.....	3	3	3	6	3
For foundry	0	0	3	6	3
Hack Saw					
Blades, hand, 18T, 10", doz..	12	12	12	12	12
Blades, power, 14T, 12", doz.	0	2	3	3	3
Frames, adjustable	6	6	6	6	6
Hammers					
Babbitt	1	1	2	2	2
Ball-peen, 13-, 16-, or 20-oz..	24	24	18	18	18
Blacksmith's, various kinds, each			1 or more as required		
Riveting, 9- and 12-oz., each.	3	3	3	3	3
Setting	3	3	3	3	3

See classified directory for sources of supply

Name and Description	Elementary School	Junior High School	Senior High School	Technical High and Full-Time Vocational Schools	Part-Time Vocational School
Indicator					
Center	0	1	1	1	1
Universal or universal dial test, each	0	1	1	2	1
Speed	0	1	1	2	1
Knurling Tool , with assorted knurls	0	2	2	3	2
Ladles					
Bull	0	0	2	2	2
Hand bowls	0	0	6	6	6
Melting	1	1	1	2	1
Lathe Dogs , $\frac{1}{2}$ ", $\frac{3}{4}$ ", 1", $1\frac{1}{2}$ ", 2", $2\frac{1}{2}$ ", and 3", each	0	3	4	6	4
Leggins , fireproofed duck, to protect students when pouring in the foundry, pairs....	0	0	12	12	12
Level , 6" bench.....	0	1	1	2	1
Lifting Screws , for molders...	0	0	6	12	6
Mandrels , selected sizes, each.	0	2	3	3	3
Mallets , wood or soft face....	3	3	4	6	4
Micrometers					
Inside, 2" to 8"	0	1	1	1	1
Outside, 0" to 1"	0	1	2	4	2
Outside, 1" to 2"	0	1	1	1	1
Outside, 2" to 3"	0	0	1	1	1
Molding Boards		Sizes and quantities as required			
Molding Sticks and Trowels , various kinds, each.....	0	0	10	15	10
Nippers , end-cutting, 5"	1	1	1	1	1
Oilstones , medium and fine, each	1	3	3	6	3
Oil Storage Tank , with pump.	0	1	1	1	1
Pails , galvanized, 12-qt. capacity for the foundry.....	0	0	3	3	3
Parallels					
Adjustable	0	2	2	2	2
Steel, assorted sizes, each...	0	2	2	2	2
Pliers					
Combination, 6"	6	6	6	6	6
Side-cutting, 6"	6	6	6	6	6
Punches					
Center, $\frac{1}{4}$ " and $\frac{3}{8}$ ", each....	0	2	3	6	3
Hollow, $\frac{1}{2}$ ", $\frac{3}{4}$ ", and 1", each	2	2	2	2	2
Pin, $\frac{1}{8}$ ", $\frac{1}{4}$ ", $\frac{3}{8}$ ", $\frac{1}{2}$ ", and $\frac{3}{4}$ ", each	0	3	3	3	3
Prick, $\frac{1}{4}$ "	6	6	6	6	6
Rammers					
Hand, for foundry.....	0	0	20	30	20
Floor, for foundry.....	0	0	6	6	6
Reamers					
Adjustable, various sizes, each	0	1	1	1	1
Hand, various sizes, each...	0	1	2	2	2
Taper pin, various sizes, each	0	2	2	2	2
With taper shank, various sizes, each	0	1	1	1	1
Riddles , $\frac{1}{4}$ " and $\frac{1}{8}$ " mesh, 18" diameter, for the foundry, each	0	0	10	15	10
Rivet Sets , assorted sizes, each	0	0	3	3	3

Use post-card service for special information

Name and Description	Elementary School	Junior High School	Senior High School	Technical High and Full-Time Vocational Schools	Part-Time Vocational School
Scales					
Steel, 6", graduated $\frac{1}{8}$ " to $\frac{1}{2}$ "	3	6	20	20	20
Steel, 12", graduated to 32nds	3	3	6	6	6
Screw Drivers					
6" blade	6	6	6	6	6
9" blade	3	3	3	3	3
Scribers	10	10	10	10	10
Shovels					
Loke	0	0	1	2	2
Sand	0	0	10	15	10
Snips					
Straight, 3" cut	1	1	3	3	3
Curved, 3" cut	1	1	2	2	2
Sockets, for taper shanks, drill and tools, selected sizes, each	0	1	1	2	1
Soldering Coppers and Handles, 1-lb. size	2	4	4	6	4
Spray Can, for molders	0	0	10	15	10
Sprinkling Cans, galvanized iron, 16-qt. capacity, for the foundry	0	0	3	3	3
Sprue Picks, for molders	0	0	10	15	10
Squares					
Machinists', 6"	6	6	6	6	6
Blacksmith's	1	1	1	1	1
Steel Figures, $\frac{1}{8}$", sets	1	1	1	1	1
Steel Letters, $\frac{1}{8}$", sets	1	1	1	1	1
Swabs, for molders	0	0	10	15	10
Tapeline, steel, 25'	0	1	1	1	1
Taps and Dies					
Machine Screws, sets	0	0	1	1	1
Pipe, sets	0	1	1	1	1
S.A.E. $\frac{1}{4}$ " to $\frac{3}{4}$ ", sets	0	1	1	1	1
U.S.S. $\frac{1}{4}$ " to $\frac{3}{4}$ ", sets	0	1	1	1	1
Tongs					
Blacksmith's, various kinds, each			1 or more as required		
Pick-up, for the foundry	0	0	3	3	3
Shake-out, for the foundry	0	0	3	3	3
Tool Holders					
Boring tools	0	3	4	6	4
Cutting-off tools	0	6	6	9	6
Planer	0	1	1	2	1
R.H. and L.H. offset shank	0	6	6	9	6
Shaper	0	1	2	4	4
Slotter	0	0	0	1	0
Straight shank	0	4	6	9	6
Threading	0	4	6	6	6
Tool-Holder Bits, square, $\frac{1}{4}$", $\frac{3}{8}$", $\frac{1}{2}$", $\frac{5}{8}$", $\frac{3}{4}$"			As required		
Trammel Points, sets	1	1	2	3	2
V Blocks and Clamps, pairs	0	2	2	4	2
Wheel Dresser	1	1	2	2	2
Wrenches					
Adjustable, 8" and 10", each	3	3	3	3	3
Pipe, 8" and 12", each	2	2	2	3	2
Tap, adjustable, various sizes, each	0	1	1	2	1

See classified directory for sources of supply

Metal-Working Supplies

20 to 25 Students Per Class

Name and Description	Elementary School	Junior High School	Senior High School	Technical High and Full-Time Vocational Schools	Part-Time Vocational School
Abrasive Wheels			As required		
Acetylene Gas , in drums, for welding			As required		
Aluminum Pigs , for foundry..			As required		
Babbitt Metal			As required		
Bearing Blue , tubes.....	0	1	1	1	1
Belt Dressing			As required		
Belt Lacing Material			As required		
Belt Leather			As required		
Bolts					
Carriage, selected sizes, lots of 100 each.....	1	1	1	1	1
Lag, selected sizes, lots of 100 each	1	1	1	1	1
Machine, selected sizes, lots of 100 each.....	1	1	1	1	1
S.A.E., selected sizes, lots of 100 each	1	1	1	1	1
Stove, flat or round heads, selected sizes, in lots of 100 each	1	1	1	1	1
Brass					
Bars, $\frac{1}{8}$ ", $\frac{1}{4}$ ", $\frac{3}{8}$ ", and $\frac{1}{2}$ " thick; $\frac{3}{8}$ " to 1" wide, 8' to 10' long, selected sizes, each	2	2	4	6	4
Round Rods, $\frac{1}{8}$ " to $\frac{1}{2}$ " by 16ths, selected sizes, feet each	20	20	40	40	40
Sheets, 28 to 32 American gauge, 12" wide by 72" to 84" long, selected sizes, sheets, each	2	2	3	3	3
Strips, $\frac{1}{8}$ " and $\frac{1}{4}$ " thick, $\frac{1}{2}$ " to 1 $\frac{1}{2}$ " wide, 50 ft. to a coil, selected sizes, coils each	1	1	1	1	1
Threaded Rods, Nos. 6 to 10, come in 12" lengths. Nos. 12, 14, $\frac{1}{4}$ ", and $\frac{3}{8}$ " come in 24" lengths, selected sizes, rods			1 or more as required		
Wire, soft, 8, 11, and 14 American gauge, selected sizes, lb.....	5	5	5	5	5
Wire, spring, 8 to 22 American gauge, selected sizes, lb.	2	2	2	2	2
Casehardening Compounds ...			As required		
Chaplets , single and double head			As required		
Coal					
Charcoal for foundry or forge			As required		
Coke for foundry.....			As required		
Forge			As required		
Copper					
Pigs, for casting alloys.....			As required		
Sheets, 8 to 25 American gauge. Size of sheets, 30" x 60". Selected sizes, sheets, each	2	2	2	2	2
Tubing, outside diameters, $\frac{1}{8}$ ", $\frac{1}{4}$ ", $\frac{3}{8}$ ", $\frac{1}{2}$ ", thickness of wall, $\frac{1}{8}$ ", lengths, 8' to 12'. Selected sizes, lengths each.....	2	2	2	2	2

Use post-card service for special information

Name and Description	Elementary School	Junior High School	Senior High School	Technical High and Full-Time Vocational Schools	Part-Time Vocational School
Copper—Continued.					
Wire, soft, 2 to 20 American gauge, in coils. Also obtainable in $\frac{1}{4}$ -, $\frac{1}{2}$ -, and 1-lb. spools, in sizes 16 to 36 English gauge. Selected sizes, pounds each.....	2	2	2	2	2
Core					
Compounds			As required		
Flour			As required		
Paste			As required		
Oil			As required		
Wax-vent wire			As required		
Cutting Compounds			As required		
Emery Paper and Cloth					
Nos. 00, 0, $\frac{1}{2}$, 1, obtainable in sheets or rolls. Selected sizes. If in sheets, quires each	5	5	10	10	10
In rolls, rolls each.....	2	2	4	4	4
File Handles , assorted sizes, each	12	12	12	12	12
Fire Bricks and Clay , for foundry			As required		
Graphite , for foundry.....			As required		
Iron					
Pig, for foundry.....			As required		
Lacquer , transparent and colored, for finishing.....			As required		
Nuts					
S.A.E., acorn cap, castellated, square, hexagon, joint, and wing. Selected sizes and kinds. Lots of 100 each	1	1	1	1	1
Oil					
Boiled linseed, gal.....	5	5	5	5	5
Lubricating, gal.....	10	10	10	20	10
Quenching and hardening...			As required		
Packing					
Round, sheet, square, or tubular			As required		
Paint , black asphaltum.....			As required		
Pins					
Cotter, $\frac{1}{8}$ " to $\frac{1}{4}$ " diam. from $\frac{1}{2}$ " to 2" long. Obtainable in boxes containing an assortment of 120 cotters...			As required		
Flask, for flask repairs.....			As required		
Taper, Nos. 0 to 6, $\frac{3}{4}$ " to 2" long. Obtainable in boxes containing 40 assorted pins			As required		
Pumice Powder			As required		
Rivets					
Copper, with burrs, Nos. 7 to 14, lengths, $\frac{3}{8}$ " to $\frac{3}{4}$ ". Selected sizes, $\frac{1}{2}$ -lb. boxes, each	1	1	1	1	1
Iron, No. 14 gauge to $\frac{1}{8}$ ", flat-head or button-head, $\frac{1}{4}$ " to 1" long. Selected sizes, lb. each.....	1	1	1	1	1
Tinners, flat-head, 8-oz. to 16-lb., either tinned or black. Selected sizes, lb. each	1	1	1	1	1
Sand					
Molding, can be had in 350-lb. barrels or 800-lb. casks.			As required		
Parting, can be had in 350-lb. barrels or 800-lb. casks...			As required		

See classified directory for sources of supply

Name and Description	Elementary School	Junior High School	Senior High School	Technical High and Full-Time Vocational Schools	Part-Time Vocational School
Screws					
Flat-head or round-head, iron or brass. Selected sizes and kinds, per hundred, each	1	1	1	1	1
Cap and machine, iron or brass. Selected sizes and kinds, per hundred, each..	1	1	1	1	1
Set, head and headless.....			As required		
Solder					
Acid or rosin core; bar, or solid wire			As required		
Soldering Paste or Salts.....			As required		
Steel					
Bessemer, rod, $\frac{1}{4}$ " to $\frac{1}{2}$ " by 64ths, in 4' lengths. Selected sizes, lengths, each.	4	4	8	8	4
Bars, cold-rolled, $\frac{1}{8}$ " to $\frac{3}{8}$ " thick, $\frac{1}{2}$ " to 2" wide, 12' lengths. Selected sizes, lengths, each	6	6	6	6	6
Drill rod, letter sizes, A to Z; number sizes, 1 to 80. Comes in 3' lengths. Selected sizes, lengths, each.	0	3	3	3	3
Rods, hexagon and square, cold-rolled, $\frac{1}{4}$ " to $\frac{3}{4}$ ". Comes in 12' lengths. Selected sizes, lengths, each.	1	1	1	1	1
Round, cold-rolled, diameters $\frac{1}{8}$ " to 1", lengths 12'. Selected sizes, lengths, each	3	3	3	3	3
Sheet, black, Nos. 18, 20, 22, 24, 26, 28 U.S. gauge; size of sheets, 24", 28", and 30"x 96". From 4 to 13 sheets in a bundle. Selected sizes, bundles, each.	1	1	1	1	1
Sheet, galvanized, Nos. 18, 20, 22, 24, 26, 27, and 28 U.S. gauge; size of sheets, 24", 28", and 30"x 96". From 4 to 12 sheets in a bundle. Selected sizes, bundles, each	1	1	1	1	1
Threaded rods, Nos. 6 to 10. Come in 12" lengths. Nos. 12, 14, $\frac{1}{4}$ ", and $\frac{1}{8}$ ". Come in 24" lengths. Selected sizes, rods each.....			1 or more as required		
Tin					
Pigs, for casting alloys.....					
1C, 1X, 20"x 48", 112 sheets to the box.....			As required		
1XX, 20"x 48", 56 sheets to the box			As required		
Washers and Burrs					
Copper, burrs, Nos. 3 to 14, in 1-lb. boxes.....			As required		
Iron burrs, Nos. 3 to 14, in 1-lb. boxes			As required		
Brass washers, $\frac{1}{8}$ " to $\frac{1}{2}$ " by 16ths			As required		
Iron washers, $\frac{1}{8}$ " to $\frac{1}{2}$ " by 16ths			As required		
Welding Fluxes					
Welding Rods , all rods come in 24" lengths.....			As required		
Brazing, $\frac{1}{8}$ ", $\frac{1}{16}$ ", and $\frac{1}{32}$ " diameter			As required		
Cast aluminum, $\frac{1}{8}$ ", $\frac{1}{4}$ ", and $\frac{3}{8}$ " diameter			As required		
Cast brass, $\frac{1}{8}$ ", and $\frac{1}{4}$ " diameter			As required		
Cast bronze, $\frac{1}{4}$ " diameter...			As required		

Use post-card service for special information

Name and Description	Elementary School	Junior High School	Senior High School	Technical High and Full-Time Vocational Schools	Part-Time Vocational School
Welding Rods—Continued					
Cast copper, $\frac{1}{8}$ " and $\frac{1}{4}$ " diameter			As required		
Cast iron, $\frac{1}{8}$ ", $\frac{1}{4}$ ", $\frac{1}{2}$ ", and $\frac{3}{8}$ " diameter			As required		
Low carbon steel, $\frac{1}{8}$ ", $\frac{1}{4}$ ", and $\frac{1}{2}$ " diameter			As required		
White Lead , for machine shop, lb.	0	0	2	3	5
Wire					
Annealed, 16 to 34 English gauge. Selected sizes, lb. each	5	5	5	5	5
Coppered market, 5 to 18 English gauge. Selected sizes, lb. each	5	5	5	5	5
Coppered spring, 2 to 18 English gauge. Selected sizes, lb. each	5	5	5	5	5
Galvanized, 5 to 18 English gauge. Selected sizes, lb. each	5	5	5	5	5
Piano, 00 to 36. Selected sizes, lb.	1	1	1	1	1
Tinned, 16 to 24 English gauge. Selected sizes, lb. each	5	5	5	5	5
Wool, No. 0 to 3 in pound packages. Selected sizes, lb. each	5	5	5	5	5
Zinc					
Pigs, for casting alloys			As required		
Sheet, Nos. 4 to 14. Sheets 36"x 84"			As required		

See classified directory for sources of supply

American Gas Furnace Co.

Elizabeth, New Jersey

Manufacturers of

Industrial Heating Appliances

Over 50 years of practical experience is back of American Gas Furnace equipment. In using American furnaces, the student will become acquainted with the same type of equipment used in so many industrial plants.

American furnaces and equipment are modern in design and construction. Write for further details.



Our products include:

Automatic Heat Controllers; Automatic Quenching Tanks; Blowers; Blowpipes or Blowtorches, Hand and Stand; Brass Melters; Burners; Burners for Electric Lamp Bulb Manufacture; Carburizing Machines; Cyanide Furnaces; Cylindrical Furnaces; Forges; Heating Machines; Melting Furnaces; Muffle Furnaces; Oil-Tempering Furnaces; Oven Furnaces; Rivet Heaters; Soft Metal and Lead Hardening Furnaces; Tube-Heating Furnaces.



Oven Furnaces

The No. 16 Oven Furnace is especially adapted for schoolroom work for hardening, annealing, normalizing, etc., where temperatures not in excess of 1800° to 2000° F. are required.

For hardening high speed steel, the No. 96 Oven Furnace is recommended. Furnace can be quickly and easily controlled as to furnace temperature and atmosphere.

Size No.	Size of Entrance Inches		Available Heating Space Inches	
	Ht.	Wdth.	Wdth.	Lgth.
*16	3 3/4	8	8	12
*96	5	5	5	9
**1	6	12	14	17

*High speed oven furnace with sliding fire brick door.

**Supplied either with hinged type cast iron door or sliding fire brick door.

Soft Metal and Lead Hardening Furnaces

Soft Metal Furnaces are designed for melting lead, babbitt, etc., and, in fact, any substance which melts under 1000° F. Lead Hardening Furnaces are equipped with stronger burners for maintaining temperatures as employed in the hardening of carbon steel, etc., and are especially adapted for the local hardening of parts.

No.	Dimensions of Pot Inches	
	Diam.	Depth
*1	6	5
*3	11 1/2	10 1/2
*5	5	11 1/2
**43	8	6 1/2

*For soft metal.

**For lead hardening.



Blowers

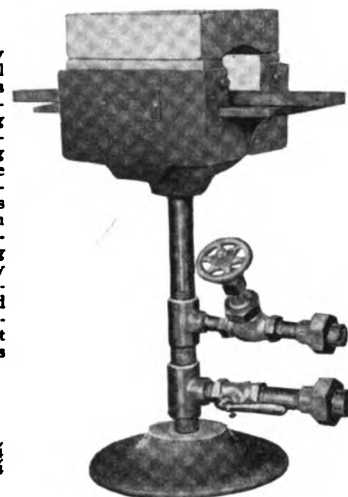
For most efficient operation, industrial furnace equipment is generally supplied to use air at a pressure of one pound per square inch. Blowers as illustrated to furnish this air can be supplied either with tight and loose pulley or motor and silent chain drive on base.

Blower No.	Cu. ft. per min. at 1 lb. per sq. in.
1	76
2	114
3	190
4	285
5	464
6	697

Bench Forges

This forge may be conveniently placed upon a bench and is ideal for quickly heating small pieces for forging, bending, tool-dressing, hardening, etc. A forging heat can be obtained in two minutes from cold. The heating space or chamber has removable plugs in both ends and a removable top brick. This permits drawing a rod or wire through the heating chamber as for annealing a long length or heating a straight rod locally at any point. With the bricks differently arranged, work may be placed so as to heat the ends of a number of pieces at a time, in fact the variety of heating operations is almost limitless.

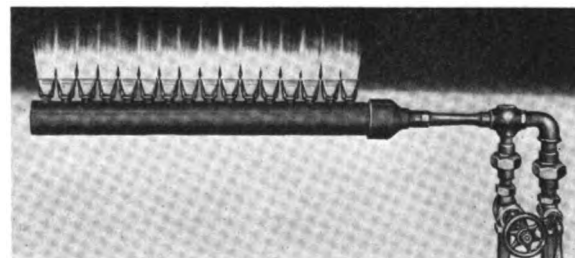
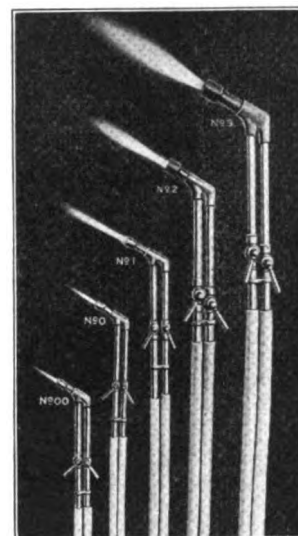
Size No.	00	0
Available Heating space, Depth.....in.	4	2
Width of Entrance.....in.	3	1 1/4
Height of Entrance.....in.	2	1 1/4



Blow Pipes

Used for soldering, brazing, welding, annealing and hardening certain small work, sterilizing, melting, etc. These blowpipes are made in six sizes, in both the hand and stand types, the flames ranging from a needle point up to 2-inch diameter by 9 1/2 inches long. The mixture of gas and air is perfect before it reaches the point of combustion. These blowpipes are so constructed that the maximum heat possible from the gas being used is obtained, and they burn well with producer gas, natural gas, artificial (city) gas, gasoline gas, etc. Air at one pound per square inch is required for their operation. These blowpipes can be regulated to produce instantly, or gradually, from a soft mild flame to the strongest flame procurable.

Blowpipe No.	Size of Flame Inches	
	Diam.	Lgth.
000	1/4	3
00	1/2	3 1/2
0	1 1/2	4 1/2-5
1	3/4	5 1/2
2	1	6 1/2
3	2	9 1/2



Burners

A wide variety of burners can be supplied according to the nature of the requirement to give a soft, focusless fire or a sharp, intense local fire. Ribbon Burners and equipment for manufacturing neon light signs is also supplied.

American Gas Furnace Co., Elizabeth, N. J.

The Black and Decker Mfg. Company

Boston
New York
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Kansas City
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Buffalo
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Dallas
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Montreal

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Slough, Bucks, Eng.

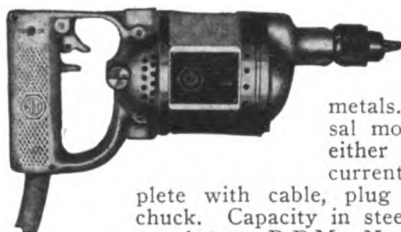
Black and Decker Electric Tools

Black & Decker Electric Tools are designed and manufactured to the highest standards, price being disregarded in the effort to turn out the finest possible product. The tremendous demand for Black & Decker tools, necessitates quantity production, and a purchase of materials in large quantities at a saving. The



manufacture on a continuous high production schedule permits us to operate our plants at highest efficiency; all of which makes it possible to supply tools of Black & Decker quality at prices little or no higher than similar tools of inferior grade.

1/4" Light-Duty Electric Drill



An ideal electric drill for the work in a school shop that does not involve heavy metals. It contains a universal motor which operates on either direct or alternating current. Drill furnished complete with cable, plug and three-jaw geared chuck. Capacity in steel, up to 1/4". No-load speed, 2,000 R.P.M. Net weight, 5 lbs.

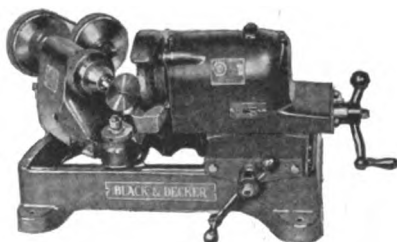
Black & Decker also manufacture a 1/4" Heavy Duty Ball Bearing Drill designed for continuous service under the most severe conditions. Capacity in steel, up to 1/4". No-load speed, 2,500 R.P.M. Net weight, 7 1/4 lbs. Where an exceptionally husky tool is required, the B & D 1/2" drill is an ideal tool for the job.

1/2-Inch Ball Bearing Electric Drill

This drill is one of the handiest tools that can be had around any type of establishment for general work and maintenance. It is light in weight, easy to handle and has such exceptional power that a man cannot stall it even with the use of a bench drill stand when drilling up to its maximum capacity. Capacity in steel, up to 1/2". No load speed, 400 R.P.M. Net weight, 12 1/2 lbs.



5/8-Inch Electric Valve Refacer

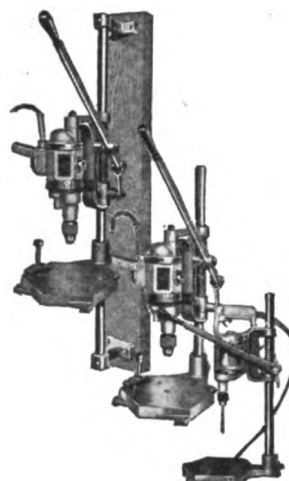


A powerful heavy duty machine for refacing Automobile, Truck, Bus, Tractor and Aircraft engine Valves. Chuck spindle and grinding wheel are independently driven by ball bearing universal motors.

The precision chuck, guaranteed accurate within .001" has a valve stem capacity 1/8" to 1 1/8". Grinding wheel feeding and traversing slides are screw operated, and are provided with automatic adjustment for wear.

Standard equipment includes, Diamond Dressing attachment for grinding wheel combined with "V" block for squaring off ends of valve stems; Valve Seat Reamer Grinding attachment complete with gauge pin to insure correct relief on reamers.

Post and Bench Drill Stands

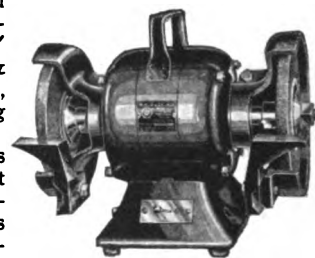


A portable electric drill, screw driver or tapper can be quickly and easily attached to the Black & Decker Bench or Post Drill Stand. The handle has a 6 to 1 leverage enabling the operator to exert tremendous power on the work. The bracket carrying the tool can be raised or lowered on the column or swung in a circle and is secured by a split collar and clamping screw.

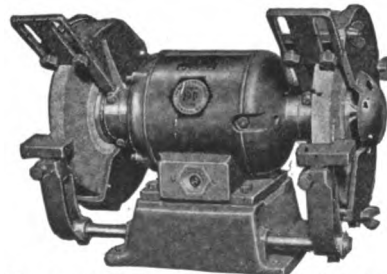
6-Inch Ball Bearing Bench Grinder

A powerful grinder with ball bearings throughout. Designed to fill the need for a 6" Bench Grinder of Black & Decker quality at low cost, for general purpose grinding and tool sharpening.

Adjustable wheel guards make it possible to grind at any position on the circumference of the wheels. This grinder is practically vibrationless, due to inherent balance and the absorptive qualities of the rubber feet. Size of wheels: 6" dia. by 1/2" face by 1/2" hole. Motor: 110 volts 50/60 cycles, single phase A. C. Net weight, 36 lbs.



10-Inch Ball Bearing Bench Grinder



A powerful ball bearing Bench Grinder designed for use on either bench or pedestal to take care of general grinding and buffing. Equipped with enclosed type safety wheel guards with an adjustable tongue to follow up the wheel wear.

Two grinding wheels, 10 inches in diameter by 1" face by 3/4" hole, one coarse and one fine are supplied as standard equipment.

No-load speed for D.C. 2,000 R.P.M.
No-load speed, 25 cycles A.C. 1,500 R.P.M.
No-load speed, 40 cycles A.C. 2,400 R.P.M.
No-load speed, 50 cycles A.C. 1,500 R.P.M.
No-load speed, 60 cycles A.C. 1,800 R.P.M.
Net weight 120 lbs.

The Black and Decker Mfg. Company, Towson, Maryland

Canedy-Otto Mfg. Company

Chicago, Heights, Illinois

Branches: 407 Broome St., New York City - 955 Folsom St., San Francisco

Manufacturers of

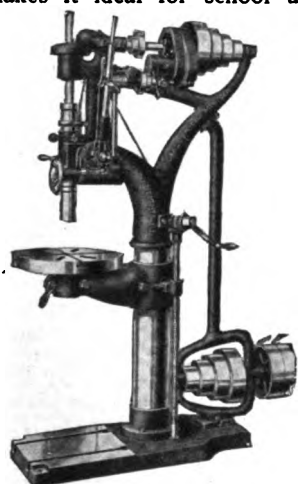
Precision Built Drilling Machines

As implied by its trade-mark the Canedy-Otto Mfg. Company products are known and used the world over. The complete line includes all types of Drilling Machines and Arbor Presses.

In the past few years especial attention has been given to the development of drill presses that would have accuracy and ease of operation—long service without repairs—at a reasonable initial cost. Their success in industry has been characterized by unusual acceptance. The various types cataloged on this page have been found to be well adapted to the school shop. Numerous school installations testify to the success of these tools and every evidence of satisfaction is apparent, from the comments made by executives and instructors responsible for the installations.

C-O 21-Inch, Back Gear, Power Feed Drill

A complete drilling machine of exceptionally rugged construction. Its ability to perform almost any drilling job makes it ideal for school use—particularly in the Auto-



mechanics Shop where it will handle any cylinder reboring or other repair job with ease. Chrome alloy steel spindle with ball thrust bearings, extra large bearings and wide faced gears reduce wear to a minimum and make the drill almost breakproof.

Specifications

Back-gear, Power Feed and Automatic Stop.
Feeds—Power, Wheel and Lever Feed.
Speeds—Eight speeds with Back-gear.
Capacity—Drills 0 to 1½-in. drills to center of 21¼-in. circle.
Spindle—Diam. in Sleeve 1½-in. Vertical travel 12-in. Graduated into ¼-in. divisions. High grade ball bearing thrust. Socket for No. 3 or 4 Morse taper.

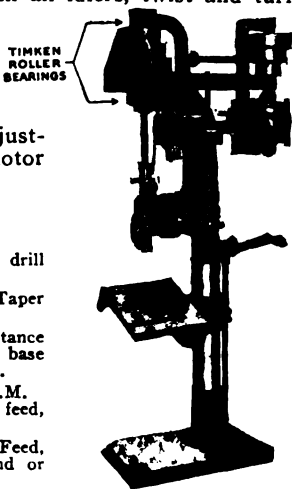
Columns—Best gray cast iron. 5¾-in. diameter.
Table—17-in. diam. 21¼-in. vertical travel. Maximum distance to spindle, 29 in.
Maximum distance spindle to base, 43 in.
Horsepower—1½ required.
Crated Weight—Complete, 920 lbs.
This drill can be furnished for puller drive as shown or with motor drive.

C-O 17-Inch Sliding Head Motor Driven Drill

This drill, either plain or equipped with Self Feed, cannot be excelled for rapid, accurate, economical drilling up to its capacity of ¾-inch. Direct connected motor delivers maximum power and does away with all idlers, twist and turn belts and greatly simplifies construction. Timken Roller Bearing used in the spindle cone pulley reduce friction to a minimum. Spindle has ball thrust bearing. Simple belt adjustment by means of movable motor bracket.

Specifications

Motor—¾ H.P.
Vertical Adjustment of Head—plain drill 12"; self feed drill 10½".
Spindle—Diameter 1½", travels 7", Taper hole for No. 2 or 3 Morse Taper.
Capacity—¾" drill. Maximum distance from spindle to table 31". Spindle to base 41". Columns to center of table 8½".
Spindle Speeds—1580-960-540-260 R.P.M.
Crated Weight—Complete with self feed, 780 lbs.
This drill can be furnished with Self-Feed, as shown, or with Plain feed. Round or tilting square table.



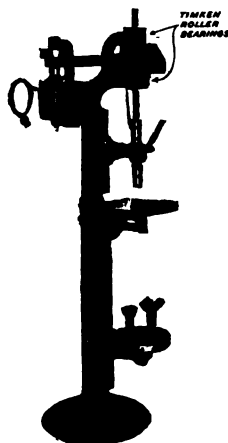
C-O 14-Inch Sliding Head Sensitive Drill

This drill is furnished in three speed ranges as follows: 400-850-1750 R.P.M., 1000-2200-5000 R.P.M., and 525-1400-3000 R.P.M. Designed for the greatest accuracy and speed in drilling holes up to ½ inch. Light socket operation and convenient toggle switch control. Timken bearings

in spindle cone pulley and ball bearing thrust. Square table may be tilted and swung around column. Round table may be raised or lowered as necessary. Comes completely equipped and ready for use. An extremely accurate, fast, durable and flexible machine for light work.

Specifications

Vertical adjustment of head, 9½".
Spindle—Diameter, ¾". Travel, 3½".
Hole for No. 1 or 2 Morse taper.
Capacity—¾" drill. Distance from spindle to square table, 0 to 16½". Spindle to round table, 0 to 40". Center of spindle to column, 7¾".
Spindle speeds—See introduction.



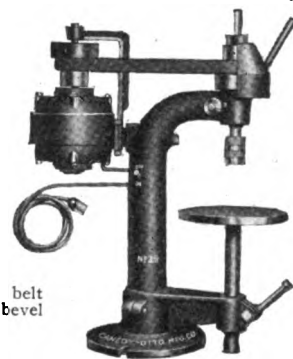
C-O No. 29 Sensitive Bench Drill

A small, accurate drill with direct belt drive from ¼ H.P. vertical type, ball bearing motor. Complete with toggle switch, cord and plug and chuck. All parts are accurately machined and balanced so as to operate at high speed entirely free from noise and vibration. Spindle is accurately ground and has ball thrust bearing.

Specifications

Spindle speeds—720-1430-3000 R.P.M.
Drills to center of 10" circle.
Capacity—0 to ¾".
Net Weight—93 lbs.

This drill can also be furnished for belt drive with power transmitted through bevel gears.



C-O Arbor Presses Nos. 1 and 3

Reinforced base gives strength and stability. Ram and Pinion forged from nickel steel, hardened and heat treated. Leverage through ratchet. Lever may always be placed at convenient position. This tool is indispensable in any shop and especially in the Automechanics department.

Specifications

	No. 1	No. 3
Capacity.....	3 tons	6 tons
Diameter of Work.....	13½"	19"
Largest Arbor.....	1¾"	2½"
Size of Ram.....	1½"	2¼"
Leverage.....	48 to 1	60 to 1
Crated Weight.....	135 lbs.	377 lbs.

Other C-O Presses are available in many styles and in capacities up to 35 tons.



Other C-O Tools

The Canedy-Otto line consists of: Drilling Machines of every type, Surface Plates, "V" Blocks, Arbor and Straightening Presses, Portable Cranes for shop use, and other machinery. We invite your correspondence and will be glad to send descriptive literature or otherwise aid in planning school shops.

Chicago Flexible Shaft Company

5529 W. Roosevelt Road, Chicago, Illinois

235 Broadway, New York, N. Y.
 311 So. Foster Avenue, Lansing, Mich.
 Pioneer Bldg., St. Paul, Minn.
 2316 Locust St., St. Louis, Mo.
 703 Magee Building, Pittsburgh, Pa.
 604 Chamber Commerce Bldg., Pittsburgh, Penn.

943 Granite Bldg., Rochester, N. Y.
 215 Pioneer Trust Bldg., Kansas City, Mo.
 2806 Santa Fe Avenue, Los Angeles, Calif.
 332 Sycamore St., Cincinnati, Ohio
 1738 Nineteenth St., Milwaukee, Wisconsin
 4805 Park Avenue, Indianapolis, Indiana

Room 310, Wesley Bldg., Philadelphia, Pa.
 1501 Heyburn Bldg., Louisville, Ky.
 79 Milk St., Room 1000, Boston, Mass.
 135 Bluxome St., San Francisco, Calif.
 317 Preston Ave., Houston, Texas.
 911 Martin Bldg., Birmingham, Ala.

Manufacturers of Industrial Furnaces

STEWART

Though space permits the illustration of only a few Stewart Furnaces that are particularly suitable for educational work, there are furnaces in the Stewart line for every heat treating requirement. For thirty years Stewart Engineers have been building up this line and today you will find a Stewart in almost every industrial plant of any size.

That is the chief reason why Stewarts are the best furnaces for educational use: The student learns heating operations with furnaces of the latest design—furnaces that he will be called upon to use when he leaves school and goes into the industrial plant.

Stewart Tool Hardening and Heat Treating Furnaces



Has U-shaped floor slab. Combustion takes place under the floor and the heat penetrates to every portion of the furnace. Flame does not strike the work, thus clean work is assured. Furnace under positive control and easy to regulate—essentials to getting uniform results.

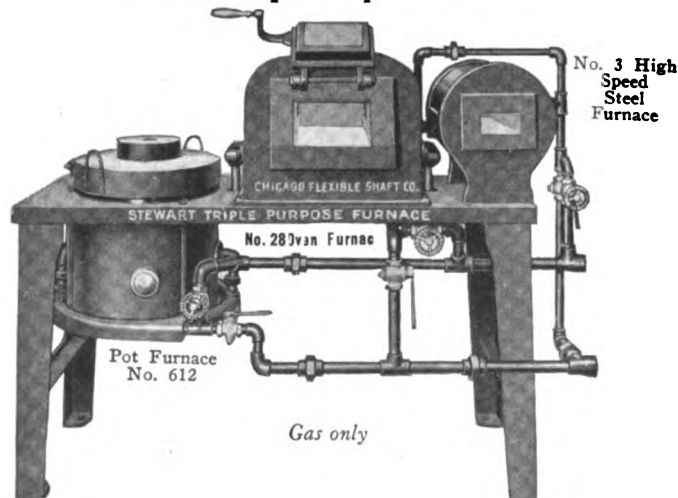
Made in the following sizes:

- No. 1—5"x 9"x 13 1/4"
- No. 2—8"x 14"x 18"
- No. 3—9"x 15"x 24"
- No. 14—6"x 10"x 15"
- No. 16—8"x 14"x 22"
- No. 26—6"x 12"x 22"
- No. 27—6"x 12"x 18"
- *No. 28—4"x 8"x 12"

No. 28 equipped with hinged door. If balanced door is wanted as shown it will be supplied without extra charge if specified at time of ordering.

Gas or Fuel Oil

Stewart Triple-Purpose Furnace



No. 3 High Speed Steel Furnace

Pot Furnace No. 612

Gas only

An assembly of three of our standard furnaces, gives the operator a complete heat treating plant. The units may be operated singly or all at one time. The left section is a No. 612 Pot Furnace, for lead or cyanide hardening or for oil tempering; it can also be used as a liquid heating medium. The center section is a No. 28 Oven for hardening and general heat treating, and can be used for high speed steel if fitted with carbofrax slab. This can be taken care of at a small additional cost. The right section is a No. 3 High Speed Steel Furnace for hardening high speed steel, and it can also be used for forging work. In addition to the above we make this in combinations of any two of the above furnaces.

- A. Combination No. 28 Oven and No. 3 High Speed Steel Furnace.
- B. Combination No. 28 Oven and No. 612 Pot Furnace.
- C. Combination No. 3 High Speed Steel Furnace and No. 612 Pot Furnace. Can also be made up in any two or three of the small furnaces shown in this catalog.

Stewart Industrial Furnaces range from the small gas-fired soldering iron heater to the great big car type annealing and porcelain enamelling furnaces. They are designed to use any kind of fuel—oil, gas, or combination oil and gas, as the requirements may demand.

So regardless of what your problem may be, Stewart Industrial Furnaces are supplied to meet any and every requirement of the industrial furnace field. You simply outline your needs and our engineers then supply the proper furnace for the job from our standard sizes if possible, or design special equipment to take care of your needs properly.

Stewart Metal Melting Furnaces



These furnaces, primarily intended for brass melting, are used by many for the melting of aluminum, nickel-silver and other non-ferrous metals with highly satisfactory results.

They are designed to use Standard Dixon Graphite Crucibles of corresponding numbers; that is, No. 12A Furnace uses No. 12 Crucible or smaller; No. 80A uses No. 80 Crucible or smaller, and so on.

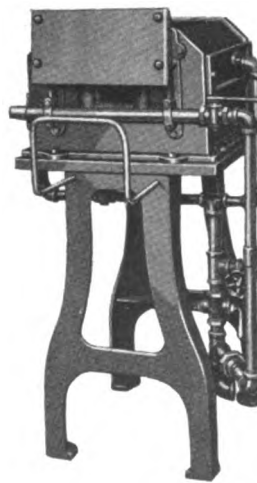
The linings are of very high grade refractory material, heavy enough to resist the abrasive action of the swirling flame which the burners set up, and the slagging action of the metals. The swinging top, made of one piece of molded refractory, banded to add strength, lifts easily from the body of the furnace by means of a special mechanism, and swings to one side, giving a clear opening into the body of the furnace—a feature much appreciated at casting time.

Gas or Oil Fuel

Furnace No.	Capacity	Size Dixon Crucible	Floor Space
12A	36 lbs. brass	No. 12	24"x 24"
35A	105 lbs. brass	No. 35	28"x 28"
60A	180 lbs. brass	No. 60	30"x 30"
80A	240 lbs. brass	No. 80	32"x 32"

In ordering, specify whether for gas or oil burners.

The Stewart School Forge



For Gas Only

This forge is built specially for class work and is much cleaner and easier to operate than the old coal burning type of forge. With this furnace the student can learn to handle the welding operations quickly—and to turn out a neat, clean job.

There is a shield and blow-pipe over the opening of this forge to keep heat away from the operator, (heat is blown upward through slot by blow-pipe). It is a safe furnace. Any boy can operate it.

Cast iron base. Steel shell. Lined with first quality refractories that will stand up for years of hard service.

Chicago Flexible Shaft Company, 5529 W. Roosevelt Road, Chicago, Illinois

The Cincinnati Milling Machine Company

Cincinnati, Ohio

Sales Representatives in Principal Cities

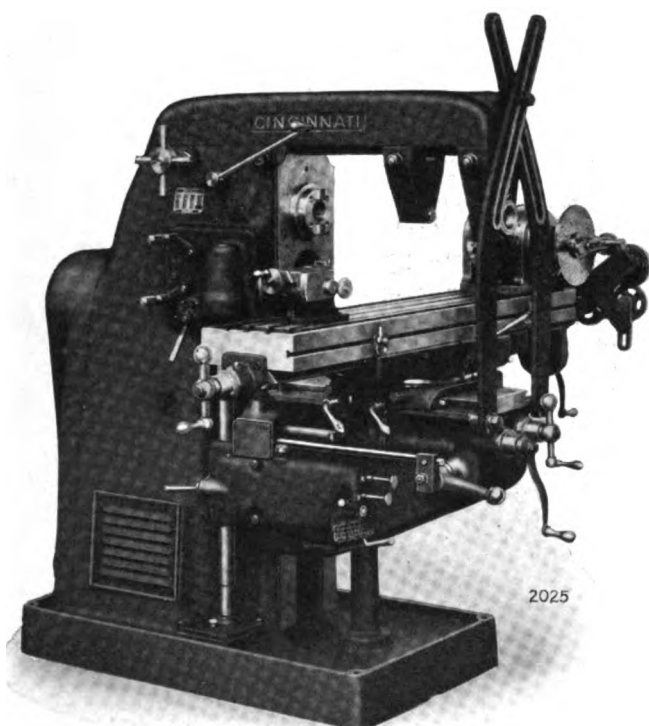
Manufacturers of

Cincinnati Milling Machines and Cutter Grinders

Cincinnati Millers have for years been standard equipment in progressive schools and colleges. An extensive list of leaders in the school field will be gladly supplied prospective purchasers of these machines.

Still Films Available

We have a number of 35 m/m still films on Cincinnati Millers (also Cincinnati Grinders, both Center-type and Centerless manufactured by our associate company, Cincinnati Grinders Incorporated) which we will be glad to send to you for use in your educational program for this year.



Cincinnati M Type Miller

The wide installation and use of the M Type Miller in the school shops has proven it to be the milling machine most adaptable for instructional purposes and one that will meet with all the requirements of the school shop. It is accepted as standard and generally used in industry, and its installation will familiarize the trade learner with the type of milling machine he is most likely to operate in the industrial plant. The M Type Miller is a highly developed machine tool with many advantageous features of safety, accessibility, and ease of control and operation. We recommend it on this account for the school shop.

Features of the M Type Miller

The Safety Factor. The greatest feature of importance relative to its use in the school shop is its safety features. Maximum safety for operators is provided. The motor is completely enclosed in the column. An automatic spindle stop permits bringing the spindle to rest instantly in case of accident, by pulling the starting lever. Universal joints have been eliminated and replaced by a shaft completely guarded by collapsible covers. All of the crank handles are provided with safety clutches, the teeth of which are covered at all times and kept out of engagement by means of safety springs. These crank handles do not turn while the machine is in operation, and do not get tangled up in the boy's clothes.

Accuracy. Cincinnati M-Type Millers insure the highest degree of accuracy. They are used extensively in industrial toolrooms where accuracy is a most important factor.

Economy. The design, construction and lubrication of Cincinnati M-Type Millers provide a machine tool that will withstand severe usage over a long period of years. Durability combined with a high degree of accuracy make Cincinnati M-Type Millers the most economical miller for school shops.

Mechanical Features

Rectangular Overarm. The easily moved rectangular overarm is a patented feature of the Cincinnati Miller. It provides a tremendously rigid support for the cutter arbor and at the same time guarantees its alignment.

Speed and Feed Changes Through Sliding Gears. All speed and feed changes can be made from the front. All shafts are of hardened steel and are mounted in anti-friction bearings. The boy does not have to walk around the machine to make any speed changes. He can drop from the maximum of 419 to the low speed of 20 in a second. These changes are made by three levers, the operation of which a boy grasps very easily. The feed changes are also made from the front. The boy can make feed changes while standing in his normal position at the front of the machine. The starting and stopping levers are available on either side and can be easily reached. This feature alone will assist to a considerable extent in eliminating possibilities of the boy operator spoiling his work.

Spindle Construction. The spindle construction of the Cincinnati Miller at the present time is very highly approved by industry. It has been subjected to unusual tests, and is known as the Four Bearing Type of Mounting. These are four heavy, substantial anti-friction bearings, which preserve the investment and long life expected of the tool in a school shop.

Lubrication. All mechanism in the column is automatically oiled. Other lubrication is taken care of by Centralized Oiling. In one minute the reservoir cups are filled, and oiling troubles are over. From each reservoir copper tubes radiate to the bearings, insuring plentiful oiling and protecting your machines. The Cincinnati M-Type Miller is furnished with either column enclosed motor drive or overhead belt drive.

Specifications

	Plain and Universal	
	†1 M	†2 M
Working surface	37" x 10 1/2"	49" x 10 1/2"
Size over all	40 3/4" x 10 1/2"	52 3/4" x 10 1/2"
Range—		
Longitudinal Feed	22"	28"
Cross Feed	8"	10"
Vertical Feed	18"	18"
Drive—		
Motor recommended	3 h.p.	5 h.p.
Floor Space	80" x 84"	80" x 102"

*NOTE: 1M Plain 19".

†NOTE: Machines equipped with power quick traverse in all directions.

Dependable Counsel on Milling. Our engineers are at the service of schools in selecting the type of milling machine most adaptable and suitable for each school installation.

Publications. A series of bulletins describing the various types of Cincinnati Milling Machines and their use are available. Write for them.

The Cincinnati Milling Machine Company, Cincinnati, Ohio

James Clark, Jr., Electric Company

600-640 E. Bergman St., Louisville, Kentucky

Manufacturers of

Clark Electrically Driven Tools

For Vocational Schools

After 29 years of successful use in a great many Vocational Schools Clark's Electrically Driven Tools are a recognized standard. They are no longer an experiment. To teach the Student to use the tool he will later in life be required to daily operate is



now a necessity. The six "Clark" tools illustrated below are used in many industries.

Write for Clark's New 1930 Catalog and prices on their complete line of Electrically Driven Tools.

"Clark's" 1/4-Inch Wonder Drill



Clark's 1/4" "Wonder Drill," Powerful, Light in Weight, and Compact, is needed in the Sheet Metal, Machine and Woodworking Shops of all Vocational Schools. Nonstallable. Code Word "Wonder."

Capacity of Chuck..... 1/4 in.
Length over all..... 7 1/2 in.
Offset of Drill from edge of frame..... 1 1/2 in.
No Load Speed..... 2000 r.p.m.
Loaded Speed..... 1200 r.p.m.
Weight..... 4 1/2 lbs.
Locking device supplied for continuous running if desired.

1/4 inch Wonder Drill
Nonstallable
Code Word "Wonder"

"Clark" Special Pattern Maker's Grinder

For the woodworking shop Clark's Special Pattern Maker's Grinder is indispensable. Being equipped with a 14" Disc Sanding wheel and a 12"x1" Grinding Wheel, the instructor is not only in a position to train the Student in the art of grinding his tools, but in the sanding of wood. Especially valuable in pattern making. The tilting table is adjustable and complete with indicator dial.



"Clark" Tool Post Grinder



To do good lathe work, it is necessary that lathe centers be kept in proper condition. Clark's tool post grinder is just the tool for this purpose. To do this all that is necessary is to clamp the grinder in the tool post of lathe and grind each center in the revolving head. It can also be used for so many other operations that its value in a Vocational School is inestimable. The swivel shank enables the student to accomplish many operations that cannot be done with grinders embodying stationary ones only. The internal attachment also adds to the value of the grinder. This tool can be supplied with or without hand feed.

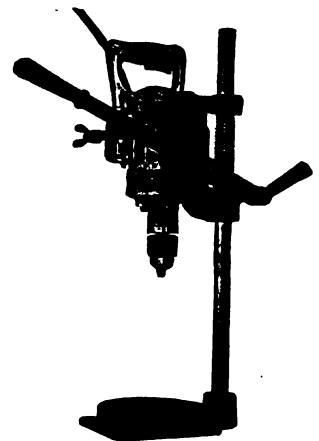
"Clark" Friction Driven Sensitive Drill



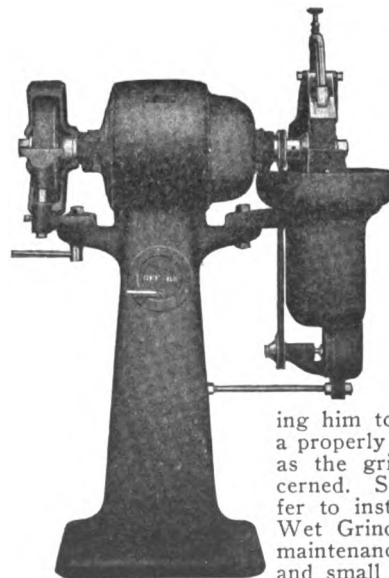
Clark's Bench and Floor Type Sensitive Drills of 1/2" and 5/8" capacity are admirably adapted to use in the various departments of any Vocational School. Their entire construction embodies features which teach the students the value of design, construction, serviceability and accuracy.

"Clark" No. 0 Drill Stand

Any of "Clark's" family of Automatic Portable Drills are adaptable to Clark's No. 0 Drill Stand, thereby making a "Two-in-One" Combination. When drill is removed from stand it serves for all kinds of portable work. Secured in the stand it meets the requirements of a small drill press, making accurate drilling possible. Automatic drills are built for 5 sizes of bits, 1/8", 1/4", 3/8", 1/2" and 5/8".



"Clark" Combined Wet and Dry Grinder



One of the best tools "Clark" builds for use in Vocational Schools is the Combination Wet and Dry Grinder. The Student is taught the art of sharpening tools on the wet wheel, thereby effecting a saving for the School Board in replacement of tools. After he has learned to successfully grind a tool without burning it, the Instructor passes him on to the dry wheel, where his training is completed, thus sending him to the commercial world a properly trained mechanic as far as the grinding of tools is concerned. Some school boards prefer to install "Clark's" altogether Wet Grinders in order to reduce maintenance costs on bits, chisels and small hand tools.

James Clark, Jr., Electric Company, 600-640 E. Bergman St., Louisville, Kentucky

The Cincinnati Shaper Company

Cincinnati, Ohio

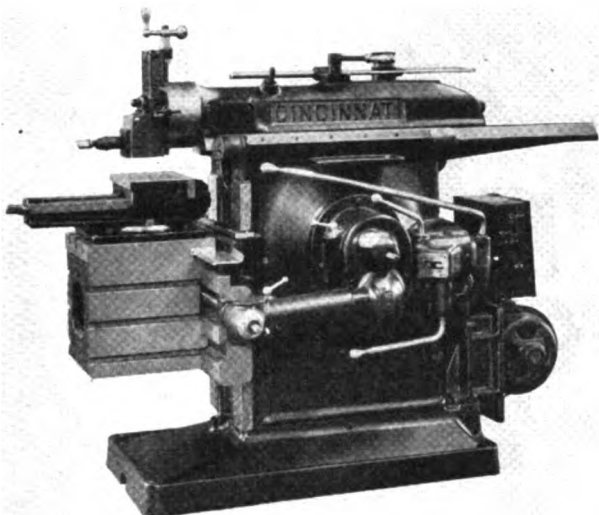
Manufacturers of

Cincinnati Utility Shapers and Cincinnati Rapid Traverse Shapers

Cincinnati Shapers are offered to the buyers of school-shop equipment who recognize that it takes modern equipment to make a modern school-shop. They are standard equipment in the nation's largest tool rooms; thus, the installation of a Cincinnati

will familiarize the trade learner with the type of shaper he is most likely to operate in the industrial plant. It is the joy of running a real tool that puts enthusiasm into the student's work when operating a Cincinnati.

Cincinnati Utility Shapers



The Utility models answer the need of many shops for a fast utility tool—a handy shaper for a moderate price—but still including all of the essential refinements of the larger shapers.

It is built with 16" or 20" stroke and is furnished for either single pulley belt drive or arranged for motor drive.

A feature of this model is the construction of the table, supported directly on the cross rail without an apron and heavy enough to carry the full load on this machine without the table support.

Omitting the apron and table support makes a less expensive machine, and at the same time saves the operator's time in setting up the work. The apron is omitted because with the smaller size machines the table is seldom removed and work clamped to the apron.

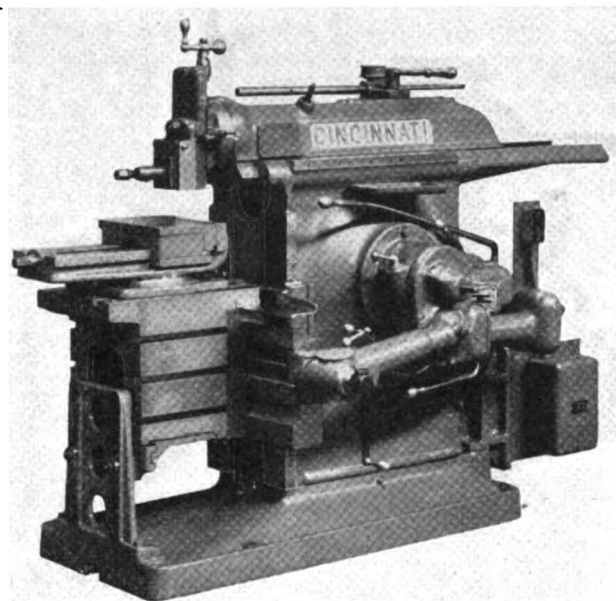
This construction adds definitely to the rigidity of the table, first by removing one intervening supporting member, second by bringing the table closer to the column and thereby reducing the overhang. Half ton test loads prove that this makes up fully for the absence of the table support.

This Utility model is especially well suited for schools as it is an example of modern design throughout, it is a make of machine which students will encounter after they are graduated into industry and it is a suitable size without large investment.

This model equipped with the Universal table carries all the advantages of the Universal Shaper.

It embodies all the other characteristics and conveniences of Cincinnati Shapers with the exception of Power Rapid Traverse.

Cincinnati Rapid Traverse Shapers



Built with 20" and 24" stroke in the standard pattern, and 16", 20", 24", 28", 32", and 36" stroke in the heavy duty pattern.

The striking features of this Power Rapid Traverse Shaper are not improvements; they are real advances in this class of equipment.

There is no need of grinding the table from one side of the shaper to the other. Power Rapid Traverse instantly shifts the table to the right position for the next job.

Visible automatic sight feed lubricating system supplies oil to the bearing surfaces of the entire shaper.

Levers for starting and stopping, for speed control, for engaging the power rapid traverse, for feed changes and for ram and stroke adjustment are all easily reached by the operator without leaving his working position.

Direct reading indicators show the setting for feed speed and length of stroke and do not move when the machine is running unless changed by the operator. All may be easily read from the operating position.

The machine is entirely guarded both for the operator's protection and for the protection of sliding surfaces against chips. In this respect the cross rail and the ram usually exposed are particularly important.

One wrench only is required for the vise, tool post screw and clamping nuts used in making settings and adjustments.

Some Cincinnati Refinements

Found in both "Utility" and "Rapid Traverse" Shapers

The Internal Transmission. The gears are placed entirely within the column doing away with the overhanging gear box attached to the side of the column. The gears themselves are chrome-nickel steel, heat-treated, run in oil and shift on solid multiple key shafts supported at both ends.

This makes a compact and powerful transmission practically noiseless, which, at the same time is accessible.

Selective Multiple Cam Feeds. The unique feature of the feeding motion is that it is actuated by a series of cams and not by an eccentric and ratchet, or by a single step cam. This gives a smooth rather than an abrupt movement, and enables the entire feed under any conditions to be confined wholly within the return stroke, results not otherwise obtained.

The Gibbed Sliding Crank Block. This is of gray iron. It has a hardened and ground steel taper gib on its driving side to compensate for wear. There is a hardened steel crank pin bearing in the gray iron

sliding block, and a hardened steel crank block gib bearing against the semi-steel rocker arm, affording ideal bearing conditions.

The taper gib on the driving side of the crank block to take up the wear between the crank block and the rocker arm is of utmost importance, as only the slightest amount of wear will cause a pronounced knock at each stroke of the ram.

Safety Factors. Proper guards for the ram, cross rail, main gear and both the slide and guide of the table support are important. They protect the machine as well as the operator. The belt and pulley guard is particularly convenient as it is adaptable to any driving condition. It can be easily arranged for either open belt or cross belt and for large or small pulleys whether directly overhead or not. When arranged for motor drive the guard entirely encloses the belt and idler pulley.

Publications. A series of bulletins describing the various types of shapers are available. Schools using Cincinnati shapers are also furnished with complete assembly drawings of the Cincinnati, which illustrate many fundamental problems of mechanics for class room use.

The Cincinnati Shaper Company, Cincinnati, Ohio

Clipper Belt Lacer Company

Grand Rapids, Michigan

Manufacturers of

Belt Lacing Equipment for Every Kind of Belting

There are many reasons why Clipper Belt Lacing is preferred—It is quickly and easily applied.

Clipper Belt Lacing is 100% Staggered.



The joint is flexible and long lasting. No two hook points enter the belt directly opposite each other, therefore, no belt fibers are broken.

Range of Adaptability

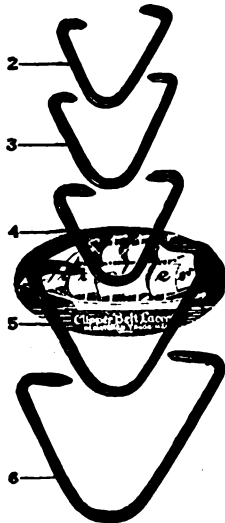


Clipper Belt Hooks are suitable for all makes of belting—balata, fabric, leather and rubber.

"Clipper" Hooks are made from a special steel wire which combines great tensile strength and ability to withstand fatigue.



Cards hold 84 hooks each and are packed 12 cards (one size) in a box with sufficient raw-hide pins. Each box will lace 80 inches—total width, both ends of belt. The following sizes are only for use in No. 0, No. 3, No. 6 and No. 8 "Clipper" Belt Lacers.



Actual Size of Hooks

	Price Per box
No. 2—For thin belts over small pulleys.....	\$0.95
No. 3—For thin belts over medium sized pulleys...	1.00
No. 4—For belts not over 1/4 inch thick.....	1.00
No. 5—For belts not over 1/2 inch thick.....	1.15
No. 6—For belts not over 3/4 inch thick.....	1.50

10% discount allowed on single purchases (one delivery) of 25 boxes or more.

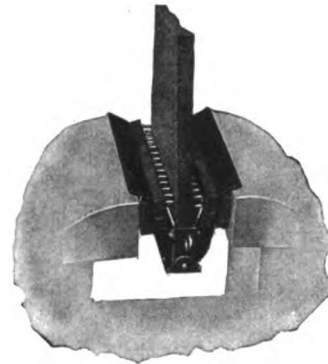
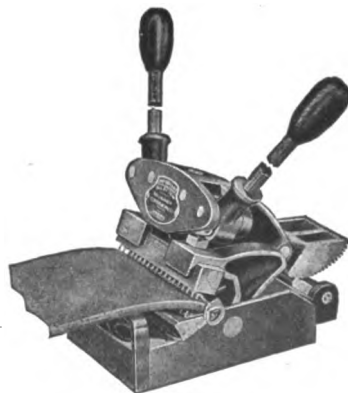
Clipper Rust-Proof Hooks

Should be used where regular hooks show corrosion due to moisture, acid fumes, etc. Add \$1.00 per box to above list prices on Nos. 2, 3 and 4. On Nos. 5 and 6 add \$1.25 per box.

Standard "Clipper" Belt Lacer No. 3

for general belt lacing work. A 24-lb. machine. Laces any size belt not over 3/4 inch thick, without removal from shaft.

Price \$25.00



"Clipper" Baby Belt Lacer No. 0

For use in any ordinary vise. Laces belts 4 in. wide and 3/8 in. thick in one operation. All "Clipper" Belt Lacers built of strongest and best materials obtainable.

Price \$3.50

The Open End Clipper Belt Cutter

Belts which are squared with the Clipper Belt Cutter will not cause any undue strain on any part of your belting fiber or lacing. A worthy companion to the Clipper line. Order one now to save valuable time and to make your lacing more efficient. Workmanship and Material fully guaranteed.



A tool for cutting belting from the roll as well as for squaring belt ends preparatory to lacing them.

6 inch closed end model.....	\$10.00
6 inch open end model.....	15.00
10 inch open end model.....	20.00

Fibro, Clipper Special and Twisted Rawhide Pins

Each package contains 24 Pins 12 inches long.

Size	Diameter	For	Price Per Package		
			"Fibro"	Special	Rawhide
No. 13, 1/16 inch, very thin belts, Nos. 1, 2 and 3 Hooks.....			\$0.35	\$0.70	\$0.85
No. 12, 1/8 inch, No. 4 Hooks.....			.35	.70	.85
No. 11, 3/16 inch, No. 5 Hooks.....			.35	.70	.85
No. 10, 1/4 inch, No. 5 Hooks.....			.40	.80	.95
No. 9, 5/16 inch, No. 6 Hooks.....			.45	.90	1.05
No. 8, 3/8 inch, No. 6 Hooks.....			.50	1.00	1.15
No. 7, 1/2 inch, heavy belts.....			.60	1.20	1.45
No. 5, 3/4 inch, heavy belts.....			.70	1.60	2.00
Assorted Sizes (Nos. 8-13).....			.40	.75	.90

Guarantee

A "Clipper" Belt Lacer is an investment—not an expense. It is sold to belting users on thirty days' free trial. Materials and Workmanship fully guaranteed.

All Prices Subject to Change Without Notice

Clipper Belt Lacer Company, Grand Rapids, Michigan

William Dixon, Incorporated

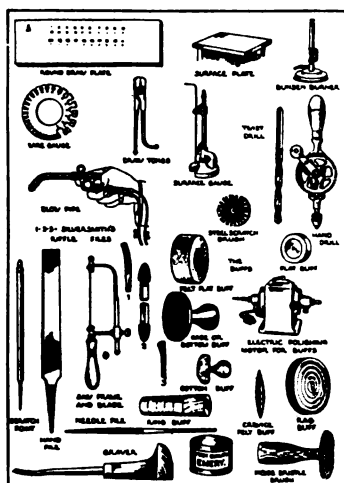
32-34-36 E. Kinney St., Newark, N. J.
110 Fulton Street, New York City 36 West 47th Street, New York City

Manufacturers, Jobbers, and Retailers of

First Quality Tools and Supplies for Art Metal Crafts and Metal Work

The house of William Dixon, Inc., has long been known as the source of finest tools and supplies for Jewelers, Silversmiths, Die Sinkers, Engravers and Art Metal Workers. For this reason Dixon Tools are well known and widely used in educational institutions that main-

Equipment for Pewter, Copper, Silver, and Arts and Crafts



This equipment has been laid out by one of the foremost authorities in the country on Arts and Crafts and Arts Metalworking in the schools—Prof. W. H. Varnum of the University of Wisconsin. It is recommended primarily for Pewter, but the same equipment has an application for Silver, Copper, and Arts and Crafts.

The equipment illustrated incorporates: Blow Pipes, Bunsen Burner, Brushes, Steel and Bristle, Draw Plates and Tongs, Drills, Files, Gravers,

Electric Motors, Riffles, Saw Frames and Blades, Surface Gauges, and Wire Gauges.

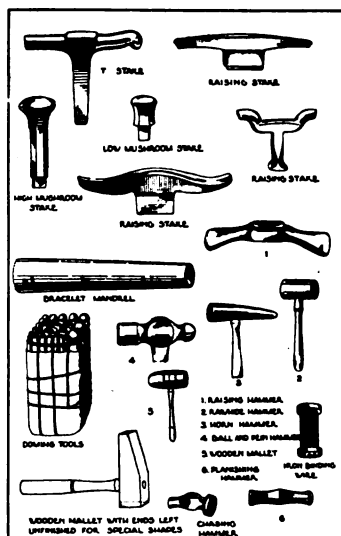
Costs vary according to type of polishing motor desired and also the number of the individual items purchased at one time. A complete equipment enumerating all of the items shown will range from \$75.00 up.

Tools

The choice of proper stake equipment is most important if a high standard of attainment in project completion is desired. For Pewter, the stakes illustrated on the accompanying chart are best. They are also adapted for Copper and Silver, though a choice is offered by having available as separate outfits the "Rose" Anvils, designed and suggested by the head of the Jewelry and Silver-smithing Department of the Rhode Island School of Design.

Tools should incorporate:—Doming or Chasing Tools, Hammers—hard and soft face, Setting, Raising, Planishing, Chasing, etc., Mandrels, Stakes, Stake Holders.

A complete tool outfit as shown can be purchased for approximately \$45.00. Individual hand tools required are furnished at a slightly higher price than when included in sets.



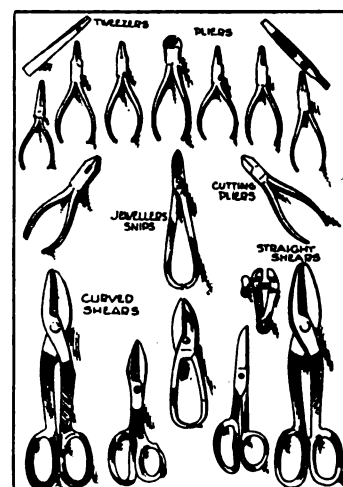
tain departments for training in Arts and Crafts.

The following outfits will afford to Supervisors and School Officials an idea of the Dixon Tools and equipment most suitable for work on silver, pewter and copper.

Tools—Cutting

This plate illustrates the cutting and holding tools best adapted for work on Copper, Pewter, Silver, and Jewelry work in the schools. A proper assortment of pliers is very important, because the better they serve and are adapted to the work the easier and better the work is done.

According to Varnum the proper individual assortment of pliers is as follows: Hand Vise, Pliers, Flat, Round Nose, Chain Nose, Half Round, Hollow Chop, Side Cutting, End Cutting, Tweezers, Soldering and Plain.



Sizes of pliers are determined by the project range and hand size. Those most practical range from 4" to 6". Prices for complete sets range from \$4.85 up.

An assortment of hand cutting tools such as pictured should also be available. They are used to assist in producing neat work and affect an economy of materials. Jewelers Snips, Tinner's Hand Snips, Straight, Curved, Plate Shears, Straight, Curved.

An assortment such as listed can be bought from \$8.25 up.

Other Tools Available

In addition to tools and equipment such as mentioned, the stocks of the house of Wm. Dixon, Inc., include an extensive line of fine tools and supplies that are of interest not alone to the Jeweler and Craftsman but also to the Machinist, Toolmaker, and Die Sinker.

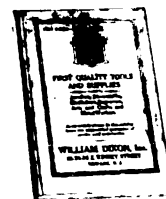
Precision Bench Lathes and accessories; Power Hack Saws; Micrometers; Scales and Squares; Blow Torches of all kinds and sizes; Drilling Machines and Drills; Grinding Wheels and Polishing Compound; Alloys; and hundreds of additional and related items are carried in stock, affording unusual opportunities to obtain equipment and tools at unusual savings.

The Dixon Catalog

This book will be found of special service in obtaining descriptions of equipment and supplies for the Metalworker and Craftsmen.

A study of it is the only means to fully comprehend the extensive Service that William Dixon, Inc., is able to give to educators.

It will be sent to supervisors and instructors upon request.



William Dixon, Incorporated, 32-34-36 E. Kinney St., Newark, N. J.

The Dumore Company

Racine, Wisconsin
Manufacturers of

Electrically Driven Motor Tools and Appliances

The Dumore Company was organized in 1913 by Mr. L. H. Hamilton and Mr. Chester H. Beach. Both of these men have had over twenty-five years experience in the manufacture of Universal Motors and electrically driven appliances.

This company now produces a varied and extensive line

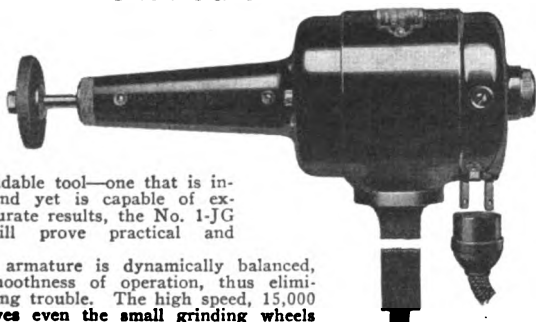
DUMORE

TRADE MARK—REG. U. S. PAT. OFF.

High Speed Grinders

of fractional horsepower motors, electrically driven tools and appliances. Every tool or appliance is equipped with a DUMORE Universal Motor. These motors operate on either alternating or direct current. The armature in every motor is dynamically balanced, assuring freedom from vibration, which results in greater efficiency.

No. 1-JG Grinder



For a dependable tool—one that is inexpensive and yet is capable of extremely accurate results, the No. 1-JG Grinder will prove practical and serviceable.

The motor armature is dynamically balanced, insuring smoothness of operation, thus eliminating bearing trouble. The high speed, 15,000 R.P.M., gives even the small grinding wheels approximately the correct surface speed. Operates on alternating or direct current.

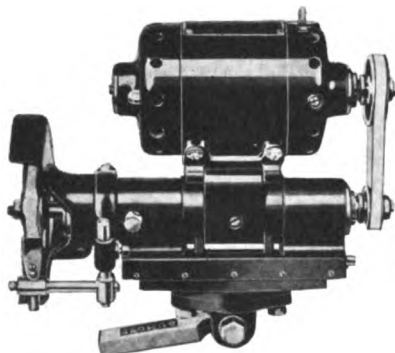
The grinder pivots on its base and may be adjusted to any desired angle or position by tightening a lock nut at the base of its shank. It handles internal and external work. The internal spindle has a reach of $4\frac{1}{2}$ ", while an additional 2" may be had by using the extension spindle regularly furnished with the grinder. Self-aligning ball bearings are used throughout.

Specifications

Motor— $\frac{1}{4}$ H.P.
Speed—15,000 R.P.M.
Approx. Current Consumption with load—1 amp.
Size of armature core— $1\frac{1}{2}$ "x2".
Reach of arm— $4\frac{1}{2}$ ".
Reach of extension spindle—2".

Bearings—Self-aligning ball bearings.
Set of six grinding wheels— $\frac{1}{4}$ ", $\frac{1}{2}$ ", $\frac{3}{8}$ ", $\frac{1}{2}$ ", $\frac{3}{8}$ ", 2".
10' cord, switch and attach. plug.
Net weight—8 lbs.
Shipping weight—11 lbs.

No. 3 Multi-Speed Grinder



The No. 3 DUMORE Multi-Speed Grinder is a large and powerful tool post grinder. Equipped with a $\frac{1}{4}$ horsepower motor, it is suitable for production as well as for tool-room use, and many manufacturers are using it on production work where precision grinding is required. Speeds varying from 3,600 to 42,000 R.P.M. can be secured by means of different combinations of the seven quick-change pulleys. These speeds give emery

wheels from 5" down to $\frac{1}{4}$ " the correct peripheral speed. Six different sizes and styles of wheel arbors and spindles are furnished. The grinder is reversible end for end and swivels as well as pivots. The motor swivels to five different positions, a decided advantage in handling "difficult-to-get-at" grinding operations.

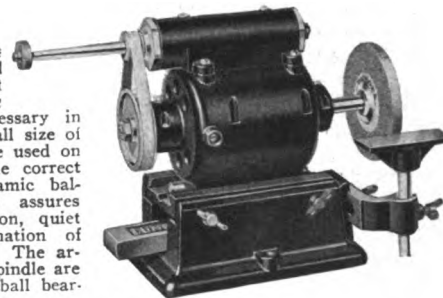
Specifications

Motor— $\frac{1}{4}$ H.P. Speed of motor—12,000-13,000 R.P.M.
Speed of spindle—3,600 to 42,000 R.P.M.
Approximate current consumption under load—3 amperes. Armature core—2"x3".
Length of travel— $5\frac{1}{2}$ ". Selected ball bearings.
Equipment—Twelve grinding wheels— $\frac{1}{4}$ ", $\frac{1}{2}$ ", $\frac{3}{8}$ ", $\frac{1}{2}$ ", $\frac{3}{8}$ ", $\frac{1}{2}$ ", 1", $1\frac{1}{4}$ ", $2\frac{1}{2}$ ", 3", 4", 5", and two $\frac{1}{2}$ " round emery pencils, seven quick-change pulleys for various spindle speeds, three extension spindles for internal work— $\frac{1}{4}$ "x2" heavy duty, $\frac{1}{4}$ "x4" heavy duty, and $\frac{1}{4}$ "x3" light duty, wheel arbor, with two sets of wheel collars, wheel arbor with special chuck and extension spindle for chuck; four endless canvas belts, wheel guard, and cutter grinding rest, cross feed lever, cord, two shanks, angle plate, feed through switch, attachment plug and steel carrying case.
Net weight—56 lbs. Shipping weight—63 lbs.

No. 2-AG Grinder

Skilled machinists have found that DUMORE Grinders, because of their high spindle speeds and perfect balance are unequaled for grinding dies, jigs, special tools and practically any grinding operation where accuracy to within 1/10,000th of an inch is required. It will fit the tool post of practically every make of lathe and may also be used on milling machines, shapers, planers, and practically any machine tool.

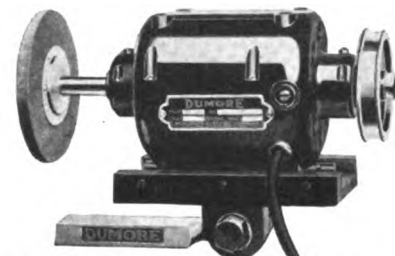
The motor spindle runs at 10,000 R.P.M. and the internal spindle at 30,000 R.P.M. These high speeds are necessary in order to give the small size of emery wheels that are used on tool post grinders the correct cutting speed. Dynamic balancing of armatures assures freedom from vibration, quiet operation and elimination of chatter on the work. The armature and internal spindle are mounted on selected ball bearings.



Specifications

Motor— $\frac{1}{4}$ H.P.
Speed, motor spindle—10,000 R.P.M.
Speed, internal spindle—30,000 R.P.M.
Reach, motor spindle— $2\frac{1}{2}$ ".
Equipment—Seven grinding wheels— $\frac{1}{4}$ ", $\frac{1}{2}$ ", $\frac{3}{8}$ ", $\frac{1}{2}$ ", $\frac{3}{8}$ ", $\frac{1}{2}$ ", $2\frac{1}{2}$ ", 4", canvas belt, wheel guard, base, cutter grinding rest, cross feed lever, 10' cord, switch and attachment plug and special steel carrying case.
Net weight—32 lbs. Shipping weight—40 lbs.

Reach, internal spindle—3".
Length of travel— $2\frac{1}{2}$ ".
Approx. Current Consumption under load—1.5 amp.
Armature core—2"x2".
Bearings—Selected ball bearings.



No. 2-OG Grinder

The 2-OG Grinder is a small, compact, efficient grinder for machine shop and tool-room use. This grinder is especially adapted to the grinding of lathe centers and many other external grinding operations. Like all other DUMORE Grinders, the 2-OG will do accurate work to within 1/10,000th of an inch.

The 2-OG Grinder can be converted into a 2-AG, 2-BG or 2-CG Grinder by the addition of three attachments—A, B, and C. Through the use of these special attachments the grinder can be quickly adapted for special grinding operations. Attachment A provides a spindle for internal grinding operations. Attachment B consists of a 10" extension arm for exceptionally deep internal work. Attachment C provides a special high-speed spindle for button die grinding.

Specifications

Motor— $\frac{1}{4}$ H.P.
Speed of motor—10,000 R.P.M.
Approx. current under load—1.2 amp.
Size of armature core—2"x2".
Equipment—Wheel guard, base, cutter grinding rest, cross feed lever, cord, switch and attachment plug.
Net weight—30 lbs. Shipping weight—38 lbs.

Reach of motor spindle— $2\frac{1}{2}$ ".
Bearings—Self-aligning ball bearings.
Set of two elastic wheels— $2\frac{1}{2}$ "x4".

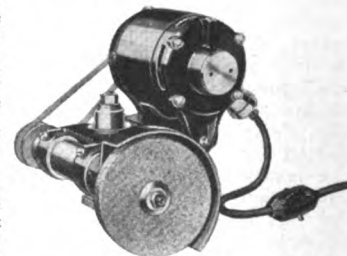
No. 5 Grinder

The new No. 5 fills a general demand for a larger and more powerful Dumore Grinder to handle heavier grinding operations in less time, and still maintain the 1/10,000" accuracy for which Dumore products are noted.

Incorporated into the design of this tool are many new features which will appeal to the machinist and mechanic. These features not only add to the convenience of handling the grinding, but make the set up in the lathe, shaper, milling machine, planer, or other machine tool a matter of seconds. In addition, they add to the life of the grinder and assure greater production under continuous operation of the tool.

Specifications

Motor— $\frac{1}{2}$ H.P.
Speed—10,000-12,000 R.P.M.
Approximate current consumption under load—3.5 amperes.
Size of armature core— $2\frac{1}{2}$ "x1 $\frac{1}{2}$ ".
Bearings—Selected ball bearings—interchangeable.
Equipment—Four quills for all types of internal and external grinding, wheel guard, three wrenches, diamond dresser, extension cord, feed-through switch, attachment plug, can of lubricating oil.
Net Weight—28 lbs. Shipping Weight, App. 46 to 50 lbs.



The Dumore Company, Racine, Wisconsin

Durabilt Steel Locker Co.

522 Arnold Avenue, Aurora, Ill.

Sales Offices in all Principal Cities



Products—Steel Lockers for all purposes.
Steel Storage and Wardrobe Cabinets.
Steel Gymnasium Racks and Trucks.



A Group of Two Tool Cabinets—one "Doorless" and one Double Door. This is a splendid adaptation of Durabilt Steel Cabinets to tool room storage needs. The illustration shows how a "Doorless" cabinet and a "Double Door" type can be used side by side, providing both closed and open storage for the hundreds of items used in auto shops and other mechanical departments of vocational schools. The wide drawers are used for storage of screws, bolts, springs, and various machine parts. All interior equipment is interchangeable and the cabinets can be moved to any part of the building, any time, to fit in with any changes of instruction or class storage demands.



Cabinet with Shelves for Tool and Die Storage.
This illustration shows a cabinet equipped with four adjustable storage shelves containing over 1,000 pounds of tools, jigs, die sets, punches, etc. Additional shelves and other interior equipment can be added if desired.



"Doorless" Cabinet
42, 66, or 78 inches
high overall.

To meet the demand for steel storage facilities where enclosed protection is not necessary we can supply Durabilt Steel Cabinets without doors. These "Doorless" cabinets, although lower in price than those with doors, are the same in every respect as our regular standard line and they are made to take any of our interchangeable and adjustable interior equipment.



Tool Lockers.

Tool Lockers

Tool Lockers fill the demand in manual training departments, and vocational rooms for the secure and convenient storage of milling cutters, as well as for other small items where a large steel cabinet may not fit in. Equipment consists of panel with 3½' adjustable pegs, 2 drawers divided into small compartments for tools, screws, nuts etc., also two shelves for miscellaneous storage.

Cord Lockers

This type of locker is very useful for the storage of cord, wire, and similar items used by vocational schools in their various branches of electrical work. Interior equipment consists of six large hanging hooks. Shelves and drawers can also be furnished when ordered.



Cord Lockers.



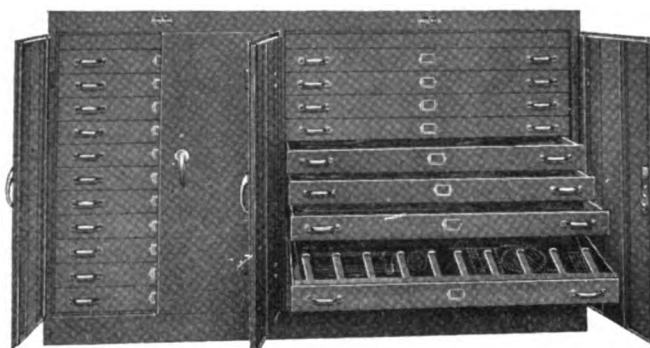
Electrotype Cabinet.

For the storage of cuts, etc., this equipment is most practical—two inch deep drawers can also be punched for attaching partitions and dividers for small tool storage requirements. (See Blue Print cabinet for further description.)



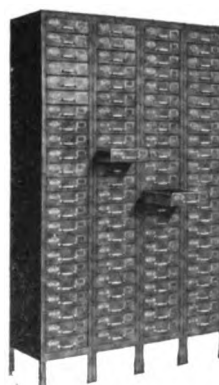
Double Door Cabinet with Shelves and Shelf Partitions.

This illustration shows how a standard Durabilt Steel Cabinet can be arranged to meet the storage requirements for various supplies, tools and equipment. Adjustable storage shelves, punched for vertical partitions, are furnished when ordered. Vertical shelf partitions can be supplied in various heights to meet storage conditions. Cabinets can be furnished without doors, when locked storage is not essential.



Blue Print, Map, and Plan Cabinets with Sliding Drawers.
30½, 42, 66, or 78 inches high overall

Any size Durabilt Steel Cabinet may be equipped with sliding drawers with tilting suspension for the safe and convenient storage of drawings, tracings, blue prints, charts, graphs, photographs, decalcomania, printing plates, electrotypes, small tools, bits, screws, drills, reamers, and thousands of other items. Sliding drawers are furnished in 2, 3, 4, 5, 6, 8, 10, and 12 inch depths overall. They can be perforated for attaching front to back partitions and left to right vertical dividers with or without label holders making it easy to arrange storage for items of various shapes and sizes.



"Doorless" Lockers with Trays

Lockers with Trays

These lockers with trays, either "Doorless" or equipped with Doors will prove their value in Vocational schools. For art, sewing, cooking and drawing classes they are often indispensable. The individual trays are easily removed for use at drawing board, desk, or table. This steel storage equipment costs less than that made of wood and is superior in every way.



Storage Lockers

Storage Lockers

Equipment consists of three inch trays supported by rigid shelves. Trays have special guides on each side which eliminate binding.

Single Tier Lockers with adjustable shelves provide unusually handy as well as economical storage for school supplies of all descriptions. Class room storage problems are readily solved by furnishing one or more units for each room or class.

Write for further information and prices. Comprehensive locker or cabinet literature will be gladly sent on request. Just mention what you want to store. No obligation to you.

Durabilt Steel Locker Co., Aurora, Ill.

Johnson Gas Appliance Co.

Cedar Rapids, Iowa

Manufacturers of

Gas Furnaces and Appliances

Johnson direct jet gas furnaces and appliances provide the highest efficiency without a forced air blast. Every Johnson Burner is fitted with the Johnson Patented Direct Jet Regulator which controls the flow



of gas by actually increasing or decreasing the size of the gas orifice, and secures perfect combustion, which results in the highest flame temperature without a blower.

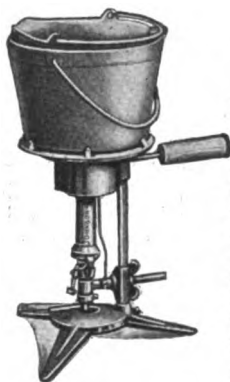
Products

All Types of Burners, Mixers, Valves, Torches, Melting Furnaces, Soldering Furnaces, Auto Blast Furnaces, Heat-Treating Furnaces, and Special and Standard gas appliances.



Laboratory Bunsen Burners

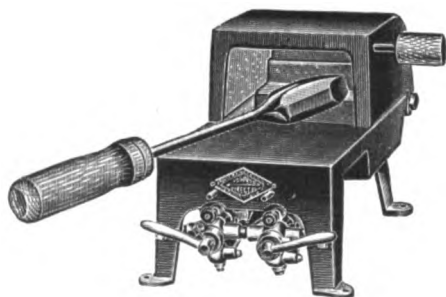
Especially designed and adapted for laboratory use by Doctors, Dentists, Chemists, and Students. A small flame will deliver a high flame temperature. The No. 4 Student Bunsen has removable top and all-white finish. Write for full details.



Adjustable Torch and Melting Pot

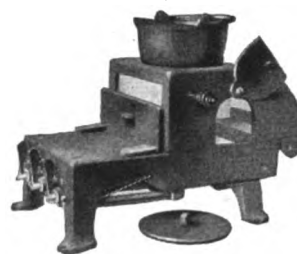
Our No. 8 Adjustable Torch and Melting Pot embodies two important features. It is a powerful, fast-working Blast Torch for general shop and laboratory use—and it functions perfectly without a blower! It also has a melting pot of 25 pounds capacity and may be used for melting soft metal such as lead, babbitt, solder, zinc and tin. Write for full details of this widely-used Shop Torch and Melting Pot.

No. 101 Bench Furnace



The Johnson No. 101 Bench Furnace will serve many useful purposes. It is designed for heating soldering coppers up to 12 lbs. per pair. Also for heat-treating, tempering, annealing, or case-hardening any carbon steel tools or small metal parts. A blower is wholly unnecessary. Here is a powerful, efficient, and economical Bench Furnace which possesses a number of outstanding, exclusive features. Write for interesting details.

No. 118 Combination Bench Furnace



The Johnson No. 118 Combination Bench Furnace may be put to many practical and profitable uses. It is quick, easy, and inexpensive to operate. With it, you may heat the largest soldering coppers. Also used for tempering, heat-treating, annealing, case-hardening, and soft metal melting. All of this is accomplished quickly and effectively without the use of forced air blast! Write for full details.

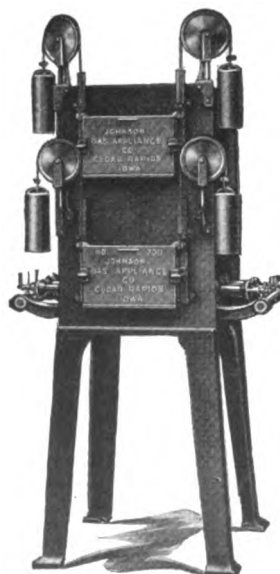
No. 15 Melting Furnace



This is the quickest lead-melting furnace made. Will melt its capacity of lead in less than 10 minutes. Economical in operation. Built to withstand hardest usage. Especially designed for Laboratories, Battery Stations, Plumbers' Shops, Garages, etc., where small quantities of metal are used. Equipped with one powerful Johnson Patented Direct Jet Bunsen Burner with shut-off valve and pilot light. No blower needed.

Other sizes of Melting Furnaces made in capacities of 50, 150, 300 and 600 lbs. for any soft metal.

Heat-Treating Furnace



It is a marvel of efficiency! The Johnson No. 700 Heat-Treating Furnace is designed for carbonizing, hardening, annealing, etc. Intense heat up to 2150 Degrees F. may be attained quickly and at small cost. Expensive blowers or motors are wholly unnecessary. The desired temperature may be maintained without noticeable variation. Stout construction will withstand long and severe usage. Equipped with six powerful large size Johnson Direct Jet Burners. Write for full details.

Write for Complete Catalogue

Johnson Gas Appliance Co., Cedar Rapids, Iowa

Kearney & Trecker Corporation

Milwaukee, Wisconsin.

Manufacturers of

The "Milwaukee" Milling Machine

Here are some matters to investigate when selecting a milling machine for the school machine shop.

Is it of modern design with the universal features necessary for student instruction? Has it been thoroughly proven, and, through satisfactory performance, been accepted by indus-

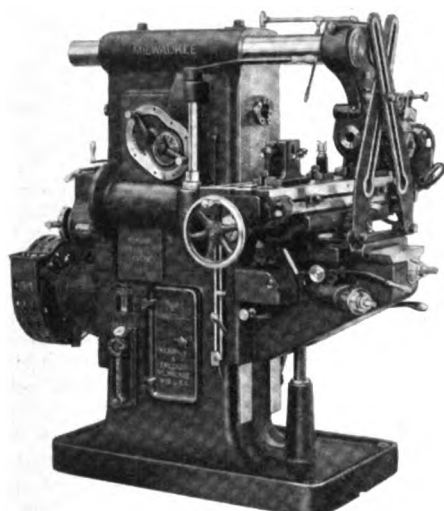


try? Has it the safety features necessary to avoid accidents or injury to students in your shop?

Kearney & Trecker Corporation offers two Milwaukee milling machines as especially suitable for use in school shops. Heavier machines are available to meet individual requirements.

No. 1 Universal

Here is the machine best suited for the smaller school shop which must make its shop dollar cover a lot of ground. The No. 1 Universal is a strictly high grade tool, and is widely used in the manufacturing field. It is fitted with the new standardized spindle end, spindle reverse, multiple disc friction clutch, swivel vise, spiral dividing centers, center rest, index plate, change gears, index chart, 3-jaw universal chuck, chuck collet and all necessary wrenches. Ordinarily equipped for belt drive from an overhead line shaft, the No. 1 may also be arranged with motor mounted on external bracket and reduction gearing to the main drive shaft.



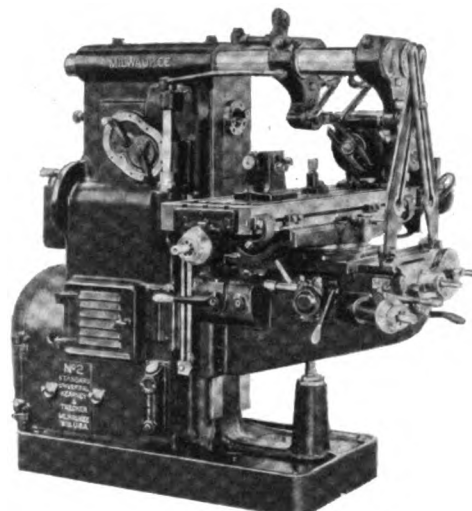
No. 1
Universal
Milwaukee
Milling
Machine

Ask for
Catalog 27-A

No. 2 Standard Universal

This machine has all of the refinements to be found in larger "Milwaukee" millers used in production shops. In it you have the advantages of power rapid traverse in all directions, all geared drive with Timken bearings throughout, and motor drive with the motor wholly enclosed within the bed of the machine. And here are some other important features—front dial feed control, duplicate front and rear control levers, self-oiling universal joints, multiple disc friction clutch, automatic lubrication and low pressure coolant system.

Standard equipment includes new standardized spindle end, spindle reverse, multiple disc friction clutch, swivel vise, spiral dividing centers, center rest, index plate, change gears, index chart, 3-jaw universal chuck, chuck collet, and necessary wrenches.



No. 2
Standard
Universal
Milwaukee
Milling
Machine

Ask for
Catalog 37

Specifications

	No. 1 Universal	No. 2 Std. Universal		No. 1 Universal	No. 2 Std. Universal
Table feed—automatic	22"	28"	Number of feed changes	12	18
Cross feed—automatic	8"	10"	Range of feed (inches per min.)	1/2" to 16"	1/8" to 25"
Vertical feed—automatic	18"	17"	Speed of driving pulley (R.P.M.)	250	600
Working surface of table	38 3/4" x 9 1/4"	50" x 12 1/2"	Diameter of driving pulley	14	14
Number of speed changes	18	18	Width of belt	4	2
Range of speed (R.P.M.)	15 to 354	17 to 420	Net weight	3300	5200

FEATURES OF CONSTRUCTION

The Column—is a one-piece, box-section, semi-steel casting, reinforced by heavy internal walls. The entire column face is hand scraped and holes for the spindle, overarms and shaft bearings are accurately aligned in proper relation to the knee slide. No drive mechanism is attached to the cover plates—the spindle gear train being built into the column.

Knee—the semi-steel, solid top, box-section type of knee, with no slots in the top at any point, resists thrust and torsion equally well. It is impossible for the saddle slide to close when clamps are set up or when a heavy cut is taken high above the table. All feed mechanism is protected from dirt and chips.

Double Overarms—two solid steel bars laced together by broad triangular arbor supports, offer the greatest resistance to deflection and assure positive alignment of the arbor at all times. The overarms are clamped in the column by two round equalizing blocks. No matter which clamping nut is tightened first, the two steel bars are always in the same position.

Arm Braces—the real purpose of the arm braces is to counteract the natural periods of vibration of the overhanging overarms and knee rather than to afford additional support for the arbor. It is impossible to get away from this natural period of vibration regardless of design or construction, but a tie between the extremities of the two vibrating bodies successfully dampens the vibration of each.

Table and Saddle—the table is a solid semi-steel casting and is finished all over. Ample metal around T-slots prevents springing. Pockets at each end of the table are provided with screens for straining chips and dirt from the coolant. Bearing of the table on the saddle is at the top of the saddle rather than at the bottom of the dovetail, thereby providing larger bearing surfaces spaced farther apart. The table is held in place by a taper gib provided with screw adjustment.

Lubrication—Automatic Flooded Lubrication has been incorporated in every K&T machine for a number of years. Lubricant is pumped from a reservoir at the base of the column and sent in a steady flood over and through all the enclosed moving parts—main spindle bearing and all other bearings and gears.

Cutter Coolant System—the built-in coolant system is standard equipment with every K&T milling machine. The automatic pump which operates only while the spindle is turning, pumps the coolant to the top of the machine from a tank in the base. Adjustable nozzles direct the coolant over the cutters and work. The coolant is strained and returned through a telescoping tube to a separate settling reservoir in the base before it again passes into circulation.

CONTROL AND SAFETY

Of major importance in the school shop is the matter of control. The new K&T horizontal starting lever extends to the front of the machine and is always at hand without reaching across the table. The lever may be set at any convenient angle by simply lifting it, turning to the desired angle, and releasing it. A short movement of the starting lever in one direction engages the driving clutch, and a movement in the opposite direction stops the spindle instantly by means of a cone brake—Safe! All hand feeds, as well as the starting lever, may be operated from one position in front of the table.

CATALOGS AND LITERATURE

Complete catalogs and descriptive literature are available on all Kearney & Trecker Milling Machines, milling attachments, inserted tooth milling cutters and arbor equipment. Your inquiries for information on Milling problems will receive careful and prompt attention.

Kearney & Trecker Corporation, Milwaukee, Wisconsin.

The Lincoln Electric Company

General Office and Factory
12030 Coit Road, Cleveland, Ohio

Branch Offices and Agents

Atlanta, Ga.	Charlotte, N. C.	Grand Rapids, Mich.	Los Angeles, Calif.	New Orleans, La.	St. Louis, Mo.
Baltimore, Md.	Chicago, Ill.	Houston, Tex.	Milwaukee, Wis.	New York, N. Y.	San Francisco, Calif.
Birmingham, Ala.	Cincinnati, Ohio.	Indianapolis, Ind.	Minneapolis, Minn.	Philadelphia, Pa.	Seattle, Wash.
Boston, Mass.	Detroit, Mich.	Kansas City, Mo.	Moline, Ill.	Pittsburgh, Pa.	Syracuse, N. Y.
Buffalo, N. Y.	Ft. Worth, Tex.	Lancaster, Pa.	Montreal, Que.	Portland, Ore.	Toronto, Ont.
					Tulsa, Okla.

Products

Lincoln "Stable-Arc" Welders, manual and automatic; electrodes and other welding accessories; Lincoln "Linc-Weld" Motors, A.C. only.

Policy

THE LINCOLN ELECTRIC COMPANY was established in 1891. This company has specialized in the manufacture of electric induction motors and electric arc-welding equipment. Through this policy of specialization it has brought its products to their high state of efficiency.

Growth of Electric-Arc Welding

In 1906 THE LINCOLN ELECTRIC COMPANY manufactured the first variable voltage welding machine for commercial purposes. Since then the use of electric arc welding has increased to such a great extent that it is used by manufacturers in practically every industry. Each day sees new applications of the process in the manufacture of practically everything made from metal. Cognizant of the importance of welding in industry, leading universities and technical schools are including in their curriculums, courses of instruction in welding engineering, and design. Lincoln "Stable-Arc" Welders have been chosen for the welding equipment by practically all of these schools.

Welding in Vocational Training

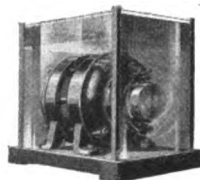
The rapidly increasing use of arc welding in industry offers tremendous opportunities for young men thoroughly schooled in welding and its applications. So great has been the demand for welding operators that it was necessary for THE LINCOLN ELECTRIC COMPANY to operate a school for training welding operators for which there is always a waiting list of applicants for admission. In high school vocational training departments Lincoln "Stable-Arc" Welders are valuable equipment in the sheet metal shops, machine shops, and auto repair shops as well as the basic equipment for general welding instruction.

Simplicity of Arc Welding

Any high school student is capable of learning the art of welding. The current for arc welding is of a lower voltage than that used on a house lighting circuit and is entirely safe in the hands of any student. The equipment is simple in construction and in principle, requires little attention other than ball bearing oilings.

"Stable-Arc" Welding Machines.

THE LINCOLN ELECTRIC COMPANY is one of the largest manufacturers of arc welding apparatus. "Stable-Arc" Welders are guaranteed to do maximum welding work under actual shop conditions. "Stable-Arc" Welders are built in a complete range of



TRADEMARK
Registered
This standard Lincoln Motor has operated under water for years.

styles and sizes, completely wired ready for immediate use.

The portable models can be easily moved from one shop to another, wherever they are needed for instruction and operating purposes.

All of these types consist essentially of:

1. A standard motor to be driven from the shop power lines. This motor furnishes the power for driving the welding generator and can be furnished with windings for any commercial current. (Where electric power is not available, a gasoline engine or line-shaft drive takes the place of the motor.)
2. A specially wound generator delivering current of the proper characteristics for welding.
3. A stabilizer acting as a reservoir of current.
4. A control panel with knife switches and meters for adjusting the amount of welding heat.

A welder occupies approximately 9 square feet of floor space.

A Lincoln "Stable-Arc" Welder of 200 ampere capacity is recommended as the most practical size of machine for instruction purposes. With this size welder, thin sheet metal may be welded as well as one-half inch plate.

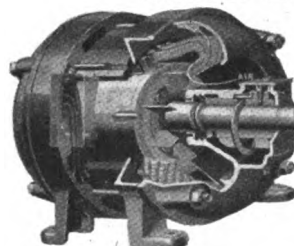
Welding Accessories

THE LINCOLN ELECTRIC COMPANY handles a complete line of welding accessories including "Kathode," "Anode," "Stable-Arc" and "Fleet-Weld" Welding Rod.

Educational Service

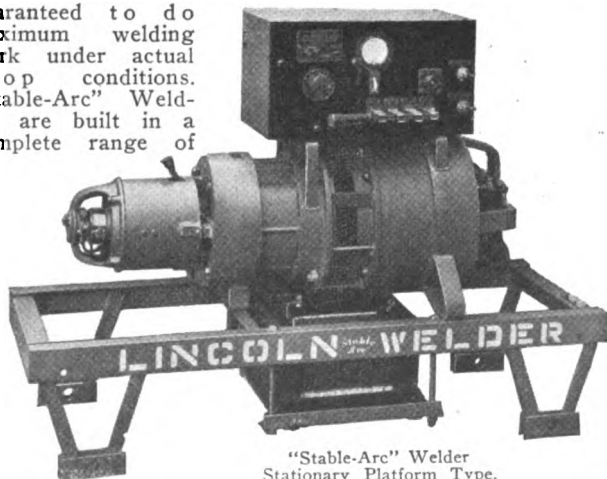
This company has a vast amount of data relative to arc welding which is available in printed form. The text book "Arc-Welding—The New Age in Iron and Steel" will be found invaluable to instructors. The price of this book is \$1.50. Instruction manuals and other bulletins are available without cost.

Lincoln "Linc-Weld" Motor

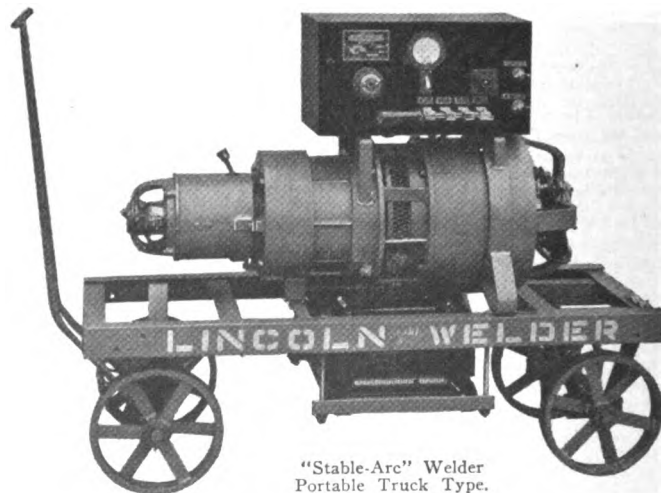


Cross Section View of "Linc-Weld" Motor.

The Lincoln "Linc-Weld" Motor is not just another motor, but is radically different from any other motor on the market. It is constructed of steel by means of the "Stable-Arc" welding process, which not only greatly increases its structural strength, but also makes possible better electrical characteristics. In brief, "Linc-Weld" Motors have: (1) Large bearings. (2) Large shafts. (3) Waterproof insulation. (4) Unbreakable steel frame. (5) Great overload capacity. These outstanding features of "Linc-Weld" Motors make them particularly well adapted for general service.



"Stable-Arc" Welder
Stationary Platform Type.



"Stable-Arc" Welder
Portable Truck Type.

The Lincoln Electric Company, 12030 Coit Road, Cleveland, Ohio

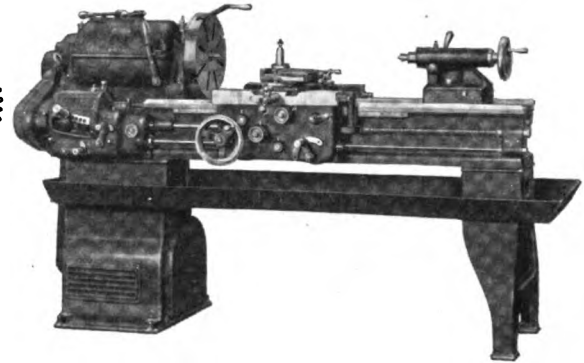
Rockford Machine Tool Co.

Rockford, Ill.

Manufacturers of

Lathes, Drill Presses, Shapers and Shaper-Planers

For the same reasons that Rockford "Economy" Lathes, Hy-Service Shapers, Hy-Draulic Shaper-Planers and Independent Drilling Machines are widely used in commercial practice they are ideal tools for school-shop use. They are distinguished by sturdy construction and ease of control. Their accuracy, and that of the work which they produce, is well within the most exacting requirements of either school or commercial shops. The materials in these machines are carefully selected, each for its special purpose. Design is in accord with the best modern practice. Anti-friction bearings are used liberally and ample provision is made for copious lubrication. These machines are extremely durable and are protected against accidental mishandling by numerous safety features. Their remarkably low price adapts them particularly to be included in requisitions for school-shop equipment. Literature describing features and attachments, together with price quotations, supplied promptly upon request.



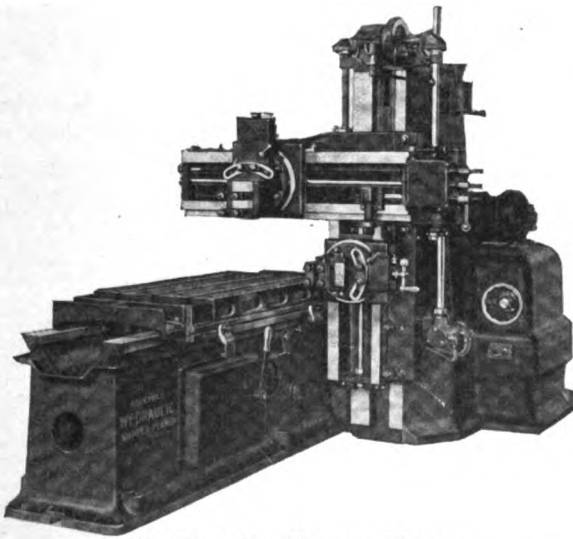
"Economy" Lathes

Specifications			
Rated Size.....	12"x 5'	14"x 6'	16"x 8'
Actual Swing.....	13 1/4"	14 1/4"	17 1/4"
Swing over Carriage.....	6 5/8"	8"	11"
Distance Between Centers.....	27"	37"	51"
Size Hole through Spindle.....	1 1/8"	1 1/8"	1 1/2"
Cone Head—			
Number of Spindle Speeds....	16	18	18
Range of Spindle Speeds,			
R.P.M.	9 to 465	20 to 435	12 to 355
Geared Head—			
Number of Spindle Speeds....	12	12	12
Range of Spindle Speeds,			
R.P.M.	16 to 402	16 to 400	15 to 385
H.P. Motor recommended,			
1200 R.P.M.	1 or 1 1/2	1 1/2 or 2	2 or 3
Range of Threads per inch....	4 to 56	4 to 56	3 to 46

Specifications

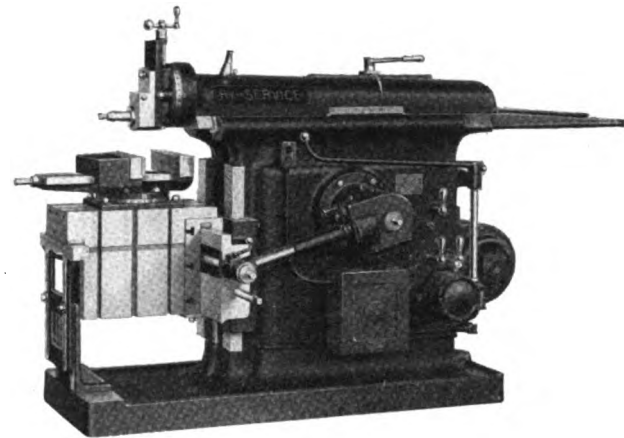
15-Inch Independent Sliding Head Sensitive Drills (Motor Driven)

Total Height of Column.....	62"
Total Height with Spindle Up.....	66"
Vertical Adjustment of Head.....	9"
Travel of Spindle.....	3 1/4"
Diameter of Spindle.....	3/8"
Spindle with Morse Taper No.....	2
Distance from Spindle to Table.....	30"
From Column to Center of Spindle.....	7 3/4"
Maximum Size of Drill.....	1/2"
Size of Table.....	11x11"
Belt Width.....	1 3/4"
Diameter of Spindle Cone Pulley.....	5.6 in. 7 1/8"
Spindle Speeds.....	415, 855, 1725
Floor Space.....	20x26"
Shipping Weight, with Motor.....	425 lbs.



Hy-Draulic Shaper-Planer

Our latest development. The outstanding feature of this machine, and one which perhaps renders it unique among machine tools is the fact that both table and feeds are operated by hydraulic power. A splendid machine for demonstrating the most advanced practice in the application of hydraulic power to machine tool movements. Oilgear pump supplies hydraulic pressure for operation of table. Another type of pump supplies hydraulic pressure for operating feed mechanism. Machine has the accuracy and easy set-up of a planer combined with the speed and convenient operation of a shaper. See special bulletin for features, details, and specifications.



Hy-Service Shapers Specifications

Size Inches	Extreme Length of Stroke Inches	Planes Width Inches	Maximum Distance Table to Ram Inches	Width and Depth of Top of Table Inches	Height Table Inches	Ram Bearing in Column Inches Length	Width
16 Hy.	16 3/4	24	16	13x16	15 3/4	32	10 1/2
20 Std.	20 3/4	24	16	13x20	15 3/4	32	10 1/2
20 Hy.	20 3/4	24	17	13x20	15 3/4	36	11 1/2
24 Std.	24 3/4	24	17	13x24	15 3/4	36	11 1/2
24 Hy.	24 3/4	26	17 3/4	14x24	17	42	12 1/2
28 Std.	28 3/4	26	17 3/4	14x28	17	42	12 1/2

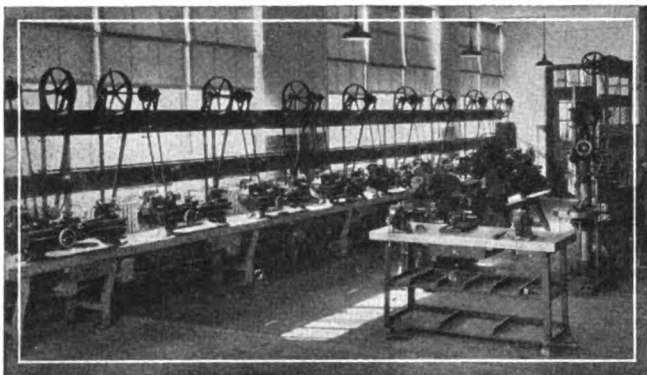
Size Inches	Length of Ram Without Head, Inches	Range of Cutting Strokes Per minute	Size of Vise Jaws Inches	Vise Opens Inches	Size Tool Post Slot Inches	Driving Pulley Belt Drive Inches	Ship. Wt. Lbs. Motor H.P.	Ship. Wt. Lbs. Without Motor
16 Hy.	39	10-130	2 1/2 x 12	14	3/4 x 1 1/2	14x4	3-5	3750
20 Std.	43	10-130	2 1/2 x 12	14	3/4 x 1 1/2	14x4	3-5	3950
20 Hy.	46 1/2	10-124	2 1/2 x 12	14	3/4 x 1 1/2	14x4	5	4400
24 Std.	50 1/2	10-124	2 1/2 x 12	14	3/4 x 1 1/2	14x4	5	4550
24 Hy.	56	10-124	3 x 14	15	1x2	14x4 1/2	5-7 1/2	5600
28 Std.	60	10-124	3 x 14	15	1x2	14x4 1/2	7 1/2	5750

Rockford Machine Tool Co., 2415 Kishwaukee St., Rockford, Ill.

South Bend Lathe Works

Established in 1906—More Than 47000 Lathes in Use
 701 East Madison Street South Bend, Indiana
 Manufacturers of
South Bend Lathes

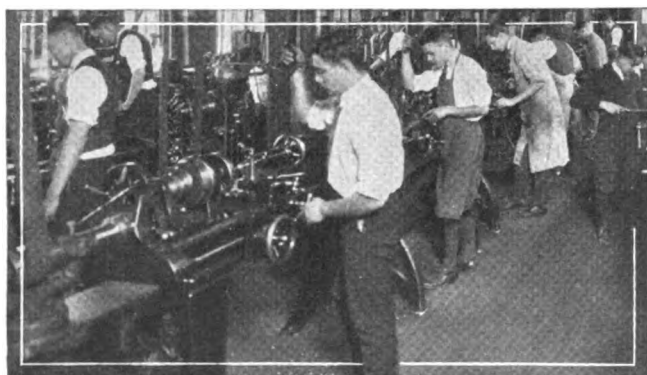
The New Model South Bend Lathes are designed and built to meet the most rigid requirements in the manufacturing plant, tool room and machine shop. They are back geared, screw cutting, precision tools of the latest type with new features and improvements that adapt them to the needs of the Junior High School, the General Shop, the High



An Ideal Junior High School installation. The lathes used are 9" swing by 3' bed bench lathes, each with its own reversing motor and reversing switch independently operated. This school solves the problem of handling a large number of students efficiently, in a limited space. Photograph taken—First Ward Junior High School, Allentown, Pennsylvania.



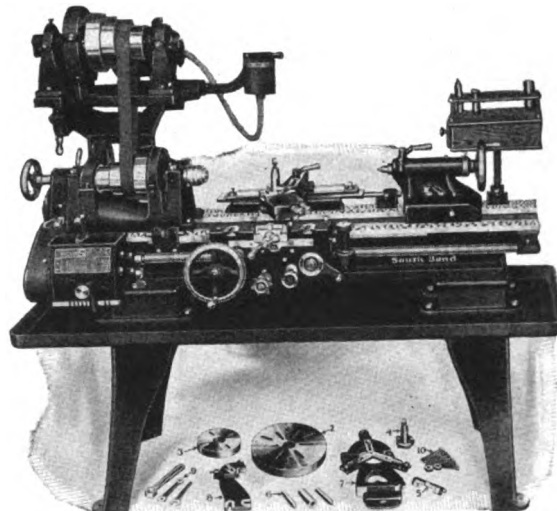
This photograph shows the Omaha Technical High School Shop installation. The sizes used here are the 11", 13", and 15" sizes, which are practical for these older students. This installation would do credit to any industrial plant.



This photograph was taken in the Trade School in Springfield, Massachusetts. Training these young men is accomplished on the 13" and 15" lathes. These sizes are suitable for the trade school, vocational school, continuation school, and engineering shop where young men and adults are taught.

School, Vocational School, Trade School, Continuation School, and Engineering School.

The low cost of the New Model South Bend Lathes permits the school to install a large number of lathes for a limited appropriation and thus take care of a larger class with a greater number of boys, yet in the limited space available under present day crowded school conditions.



**13" x 5' New Model Toolroom Quick-Change
 Gear Precision Lathe With Silent Chain
 Motor Drive, Price, \$799**

This New Model Lathe, weighing 1510 lbs., with swing capacity of 13 $\frac{3}{4}$ " and capable of handling work up to 28" long, is practical for 90% of the work coming up in the school shop.

The 11" lathe has also proved a popular size on which to train the student. The nucleus of the great Ford organization of today had its inception when Henry Ford built, with his own hands, on an 11" lathe, the principal parts of his first automobile.

The New Model South Bend Lathes are made in 96 sizes and types from 9" to 24" swing, both countershaft and motor drive.

These booklets contain valuable and interesting information which can be used by every instructor, supervisor, or school director. They will be sent to any educator free of cost.

"How to Run a Lathe"—A 144 page text on the care and operation of the screw cutting lathe. Thirty years' experience of practical mechanics.

Catalog No. 90-A—96 page booklet illustrating, describing, and pricing 96 different types and sizes of New Model South Bend Lathes.

Handbook No. 44—32 page booklet showing up-to-date and modern methods of handling machine jobs in industrial plants.

"Training the Apprentice for Industry"—Bulletin No. 14—A 64 page booklet showing 84 school installations and buildings throughout the world. Also equipments for the school shop. All sent free, postpaid.



FREE ON REQUEST

South Bend Lathe Works, 701 East Madison Street, South Bend, Indiana

The Standard Electrical Tool Co.

Established 1912
Cincinnati, Ohio
Manufacturers of

Electric Drills, Grinders and Buffers

Standard Electric Tools are recognized as leaders in their line. Designed in accordance with sound engineering principles and constructed carefully from the highest grade materials obtainable, they are truly "Standard" with American Industry.

The full line of Standard Electric Tools includes all types of portable drills, post and bench drill

S

stands for converting portable drills, center grinders, angle plate grinders, aerial or hand grinders, bench and pedestal grinders and buffers.

Highest grade ball bearings are used in Standard Electric Tools where best adapted, and all bearings are provided for proper lubrication and are thoroughly protected from grit and dust.

Portable Electric Drills

Portable electric drills have come into such universal use that they are now counted among the most necessary of shop tools. The Standard $\frac{1}{4}$ " $\frac{1}{2}$ " and $\frac{3}{8}$ " drills pictured here represent the highest development of this type of hand tool. Motors are General Electric, Universal, for either A.C. or D.C. operation. SKF ball bearings insure easy running and long life. The chrome-nickel steel gears are accurately cut and run in grease, thereby aiding quietness and smoothness of operation. The handy, automatic trigger switch built right into the grip handle is a minor detail yet a great aid to convenience.



Among the Standard drills designed for heavier work, the $\frac{3}{8}$ ", $\frac{1}{2}$ " and $\frac{5}{8}$ " models have proven very popular. The fact that they may be used with equal success on either A.C. or D.C. of the rated voltage adds to their convenience and versatility. Although rugged and built to withstand much abuse they are not heavy in proportion to their capacity.

$\frac{3}{4}$ ", $\frac{7}{8}$ ", 1", $1\frac{1}{4}$ " and $1\frac{1}{2}$ " sizes with screw feed are also available and like all Standard drills are

equipped with SKF ball bearings and chrome-nickel steel gears.

Tool Post and Center Grinders

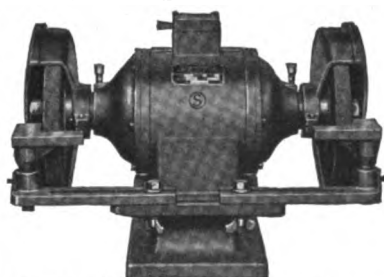
Standard Tool Post or Center Grinders are made in $\frac{1}{4}$ and $\frac{1}{2}$ h.p. sizes with General Electric D.C., A.C. or Universal motors. The value of these precision machines in



the school shop cannot be overestimated and their use in connection with the Lathe, Milling Machine, Shaper and Planer is essential for proper student instruction. Furnished with or without horizontal feed. Regular equipment includes tool rest and extension mandrel for small inside grinding.

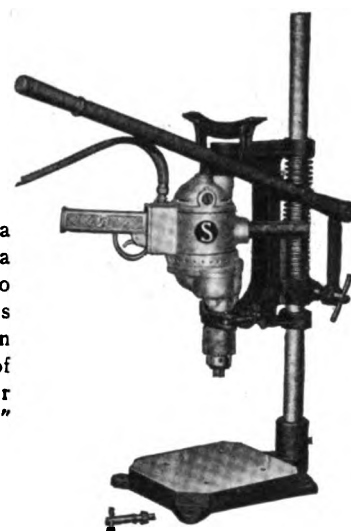
Bench Grinders

Standard Ball Bearing Bench Grinders for work on small tools and castings are made in $\frac{1}{4}$, $\frac{1}{2}$, 1 and 2 h.p. models for either A.C. or D.C. operation as specified. Quick make and break switch totally enclosed, is conveniently located on top of motor. Can be furnished with two wheels of different grits or with one buffing wheel if desired. Pedestal models for floor mounting are available.

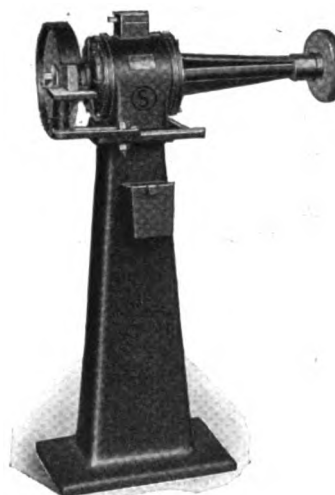


Combination Bench Drill Stand for Portable Electric Drills

This quickly converts a portable Hand Drill into a Bench Drill, giving two tools in one. The drill is our regular tool and can be used independent of stand. Stand made for $\frac{3}{8}$ ", $\frac{1}{2}$ ", $\frac{5}{8}$ ", $\frac{3}{4}$ ", and $\frac{7}{8}$ " sizes.



Combination Grinders and Buffers



Ball Bearing Combination Grinders and Buffers are obtainable in $\frac{1}{2}$, 1, 2 and 3 h.p. sizes with either A.C. or D.C. motors. Either pedestal or bench models. High grade nickel steel shafts and carefully balanced armatures running in dust protected SKF ball bearings make Standard machines smooth running and long lived. Handy quick make and break switch located on top of motor. Water pot and tool rest for grinder are included.

Pedestal Grinders

3 and 5 h.p. Ball Bearing Pedestal Grinders have General Electric 40 deg. motors with convenient push button control. Automatic motor control housed in pedestal requires no manual operation or attention. SKF bearings are dustproof. Nickel steel armature shaft. Carefully guarded for safety. Wheel guards have spark breakers and wire glass eye shields. Exhaust connections and adjustable tool rests.

Complete catalog and discounts will be furnished upon application.



The Standard Electrical Tool Co., 1938 W. Eighth St., Cincinnati, Ohio

Sterling Wheelbarrow Company

Milwaukee, Wisconsin

Branch Offices and Warehouses

Chicago, New York, Philadelphia, Boston, Pittsburgh, Cleveland, Detroit, St. Louis

Foundry and Industrial Specialties

Over 3,000 foundries (more than 60% of the recognized foundries in the United States) use Sterling "Rolled Steel" flasks in preference to any other. Sterling is the only "Rolled Steel" flask made. A few of their many types are shown here. A request for catalog will bring you one of the most descriptive flask books issued describing not only the construction of the ordinary style flask but illustrating a number of special constructions that are possible in "Rolled Steel." Sterling "Rolled Steel" foundry flasks can be obtained in any size, shape or style—for bench, floor or machine moulding of any metal.

Sterling

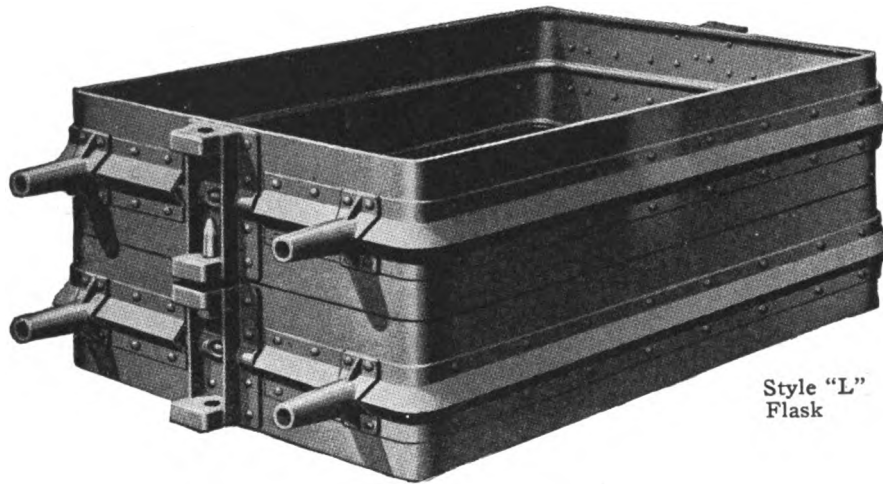
"Rolled Steel" flasks cost less per hour of use—increase production—cut labor, time and effort—and last much longer.

"Rolled Steel" flasks have greatest strength—rigidity—accuracy, and lighter weight than cast iron.

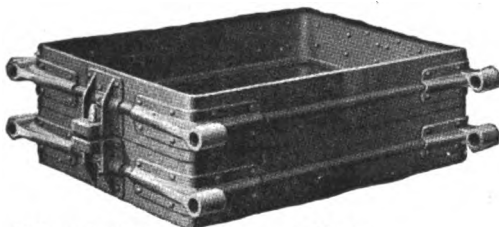
"Rolled Steel" flasks can't burn —can't break—can't twist, and are always level at the partings.

—can't break—can't twist, and are always level at the partings.

"Rolled Steel" flasks save sand and floor space and because they are of "steel" will last longer under the terrific abuse of machine moulding.

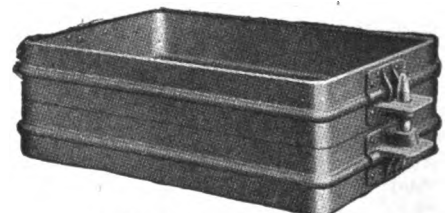
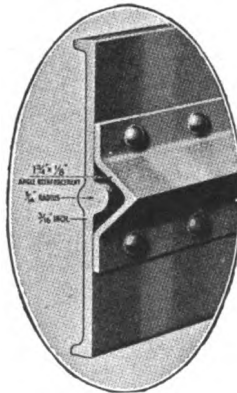


Style "L"
Flask



(Above) Style GGR—excellent for light floor work or medium size moulding machines.

(Center, below) Style BBL—the best flask for circular work. Built in diameters from 18" to 48".

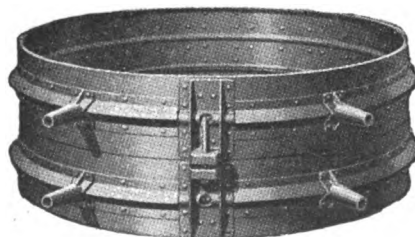


(Above) Style AA—just the type for small and medium size work.

(Oval) Sectional view of the "rolled steel" construction. The center rib imparts rigidity that means full accuracy at all times—no twist—no strain.



Wheelbarrow
No. 7



Truck
No. 44

Other Sterling products for foundry use are—Wheelbarrows, Core Barrows, Bottom Board Barrows, Pig Iron Trucks, Slag Buggies, Charging Cars, Flask Pins, Wood Wedges, Shop Boxes, Skim Gates, Flask Bands, Trucks, etc.

Sterling Wheelbarrow Company, Milwaukee, Wisconsin

The United States Electrical Tool Co.

2463 W. Sixth Street, Cincinnati, Ohio

Manufacturers of

Electrically Driven Drills and Grinders

United States electric tools have been on the market for over 30 years. Their performance, through rugged design and careful workmanship, has built a reputation that is world wide.



The name, The United States Electrical Tool Company, stands for merit and honest value in all tools upon which it is stamped.

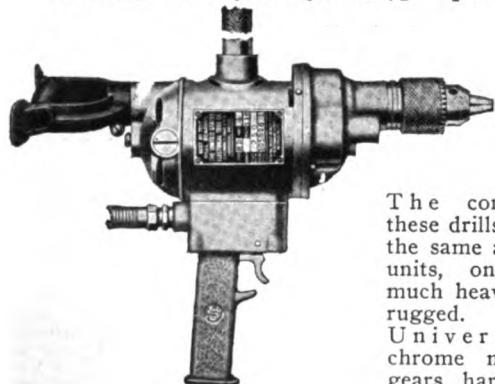
U. S. $\frac{1}{4}$ " Special, $\frac{1}{4}$ " Regular, $\frac{1}{4}$ " Heavy Duty and $\frac{5}{16}$ " Drills



The motors of these drills are universal and will operate on Alternating or Direct current of the same voltage. Commutator brushes accessible from outside. Armature runs on S. K. F. Ball Bearings, gears are made of chrome nickel steel, heat treated, run in grease-tight compartment. Chuck is Jacobs, threaded back. Thrust bearing is S. K. F. Ball. Keyless chucks can be furnished upon request without extra charge.

	$\frac{1}{4}$ " Special	$\frac{1}{4}$ " Reg.	$\frac{1}{4}$ " H.D.	$\frac{5}{16}$ "
Capacity in Metal....	$\frac{1}{4}$ "	$\frac{1}{4}$ "	$\frac{1}{4}$ "	$\frac{1}{4}$ "
Capacity in Wood....	$\frac{1}{4}$ "	$\frac{1}{4}$ "	$\frac{1}{4}$ "	$\frac{1}{4}$ "
Weight	4 $\frac{1}{4}$ lbs.	5 $\frac{1}{4}$ lbs.	7 lbs.	7 lbs.
Full Load R.P.M....	2000	2000	2000	1000
Dimensions	10 $\frac{1}{2}$ "x2 $\frac{3}{4}$ "	12"x3 $\frac{3}{4}$ "	13"x3 $\frac{3}{4}$ "	10"x3 $\frac{3}{4}$ "

U. S. $\frac{3}{8}$ " Heavy Duty and $\frac{1}{2}$ " Special Drills



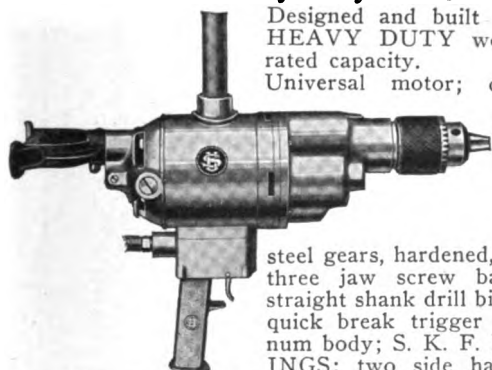
The construction of these drills is practically the same as the smaller units, only they are much heavier and more rugged.

Universal motor; chrome nickel steel gears, hardened, run in

grease; quick made, quick break 2 pole trigger switch; three jaw screw back chuck for straight shank drill bits; aluminum body; S. K. F. BALL BEARINGS; two side handles—one removable; combination breast plate and spade handle; 12 feet flexible rubber covered cable and armored attachment plug.

	$\frac{3}{8}$ " H. D.	$\frac{1}{2}$ " Special
Capacity in Steel.....	$\frac{3}{8}$ "	$\frac{1}{2}$ "
Capacity in Hardwood.....	$\frac{3}{8}$ "	$\frac{1}{2}$ "
Weight	14 lbs.	14 $\frac{1}{2}$ lbs.
Full Load R.P.M....	750	450
Dimensions	4 $\frac{1}{2}$ "x16"	4 $\frac{1}{2}$ "x16 $\frac{1}{2}$ "

U. S. $\frac{1}{2}$ " Heavy Duty, $\frac{5}{8}$ ", $\frac{3}{4}$ " Special and $\frac{3}{4}$ " Heavy Duty Drills



Designed and built for continuous HEAVY DUTY work at its full rated capacity.

Universal motor; chrome nickel

steel gears, hardened, run in grease; three jaw screw back chuck for straight shank drill bits; quick make, quick break trigger switch; aluminum body; S. K. F. BALL BEARINGS; two side handles—one removable; combination breast plate and spade handle; 12 feet flexible rubber covered cable and armored attachment plug.

	$\frac{1}{2}$ " H. D.	$\frac{3}{4}$ "	$\frac{3}{4}$ " Special	$\frac{3}{4}$ " Heavy Duty
Capacity in Steel.....	$\frac{1}{2}$ "	$\frac{3}{4}$ "	$\frac{3}{4}$ "	$\frac{3}{4}$ "
Cap. in Hardwood.....	$\frac{1}{2}$ "	$\frac{3}{4}$ "	$\frac{1}{2}$ "	$\frac{1}{2}$ "
Weight	22 lbs.	23 $\frac{1}{2}$ lbs.	18 lbs.	23 $\frac{1}{2}$ lbs.
Full load, R.P.M....	450	400	450	400
Dimensions	5"x18"	5"x19"	4 $\frac{1}{2}$ "x19"	5"x24"

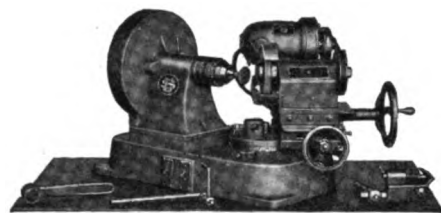
Three-wire cable with plug.....\$2.50 extra
Higher speeds can be furnished at.....\$2.50 extra

U. S. Model "AA" Valve Refacer

The Model "AA" valve refacer is equipped with two universal motors for operation on direct or alternating current of 60 cycles or less, is designed to take any valve with stem of $\frac{5}{8}$ " diameter or less, any length, can be set for any angle valve 0 to 75 degrees.

The grinding wheel spindle runs on S. K. F. BALL BEARINGS and is driven through fabric belt from the driving unit mounted on common base with the spindle housing.

The valve holding spindle runs on ball bearings and is belted to driving motor; this insures smooth operation. An automatic belt tightener eliminates intermittent belt tension adjustment.

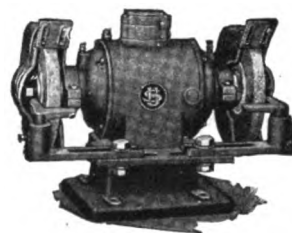


Standard equipment includes diamond wheel dresser, V block for truing valve stem ends, Cutter resharpening indexing support and electrical connections complete.

Our line also includes a Pressed Steel Table for Model "AA" Valve Refacer.

U. S. Bench and Floor Type Grinders

U. S. Grinders can be had in any size in both Bench and Floor type. The motors are straight Alternating or Direct Current. When ordering specify voltage for D.C. and if for A.C. give voltage, cycle, and phase.



The motors are Westinghouse, 40 degree, entirely enclosed. Switch is mounted on motor body, convenient to operator. Design of switch depends upon size of unit and current specifications. Shaft is nickel steel, supported by S. K. F. Ball Bearings. Bearings are in dust-tight compartments. Guards of all models, except 6" and 7" sizes, are totally enclosed type. Standard equipment includes 2 grinding wheels, one coarse, one fine; guards; adjustable tool rests and electrical connections complete.

	$\frac{3}{4}$ "	$\frac{1}{2}$ "	$\frac{1}{2}$ "
Horsepower	$\frac{3}{4}$ "	$\frac{1}{2}$ "	$\frac{1}{2}$ "
Size Wheels.....	6"x $\frac{1}{2}$ "x $\frac{1}{2}$ "	7"x $\frac{3}{4}$ "x $\frac{1}{2}$ "	8"x1"x $\frac{3}{4}$ "
Load Speed.....	3450	3450	3450
Dimensions	14"x10"	15"x10"	16"x11"
Net Weight.....	45 lbs.	50 lbs.	115 lbs.
Horsepower	1	2	2
Size Wheels.....	10"x1"x $\frac{3}{4}$ "	12"x1 $\frac{1}{2}$ "x1 $\frac{1}{4}$ "	12"x1 $\frac{1}{2}$ "x1 $\frac{1}{4}$ "
Load Speed.....	1750	1750	1750
Dimensions	17"x15"	20"x18"	20"x18"
Net Weight.....	155 lbs.	342 lbs.	342 lbs.

Above are bench specifications. Other sizes, 14", 18", 20", 24" and 30".

The United States Electrical Tool Co., 2463 W. Sixth Street, Cincinnati, Ohio

The Van Dorn Electric Tool Co.

Cleveland, Ohio
Manufacturers of

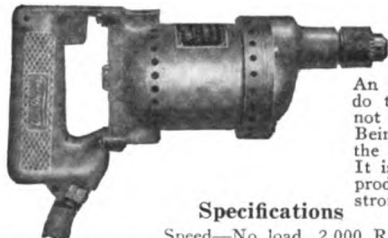
Electric Drills and Grinders

For over twenty-five years Van Dorn Electric Tools have been recognized as leaders in the automotive and industrial fields. This is substantiated by the use of Van Dorn Tools in all types of industrial plants, from the smallest machine shop to the largest automobile factories, and by their universal

"Van Dorn"

acceptance in garages, service stations, battery shops and all other kinds of shops for the efficient and modern servicing of automobiles. This recognition has been won through constant development to meet the ever-changing demands of industry.

¼-inch Light Duty Electric Drill

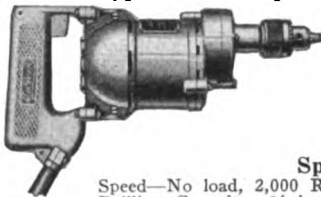


An inexpensive drill, designed to do the many little jobs that do not require a heavy duty tool. Being light and compact it is the ideal drill for the tool kit. It is not intended for continuous production drilling—but is a strong general-purpose drill.

Specifications

Speed—No load, 2,000 R.P.M.
Drilling Capacity—¼ inch.
Equipment—3-jaw Chuck, Switch, 10 ft. Cable and Plug.
Weight, 5 lbs.; Length, 10½ inches.
Code No. D-100. Price.....\$25.00
Furnished for 32, 110, 220 or 250 volts.
Universal Motor operates on Direct or Alternating Current.

¼-inch Heavy Duty Electric Drill

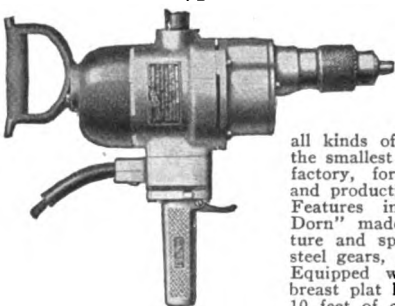


The latest development in a Heavy Duty ¼-inch Electric Drill. Adapted for speedy, continuous production drilling—also for driving Valve Seat Hones, Carbon Cleaning Brushes, Valve Guide Cleaners, Wire Brushes and other attachments used daily in Service Stations.

Specifications

Speed—No load, 2,000 R.P.M.
Drilling Capacity—¼ inch.
Equipment—3-jaw chuck; 10 ft. electric cable with plug.
Weight—5½ pounds. Shipping weight—7½ pounds.
Code No. D-8100. Price.....\$36.00
Furnished for 32, 110, 220 or 250 volts.
Universal Motor operates on Direct or Alternating Current.

½-inch Electric Drill

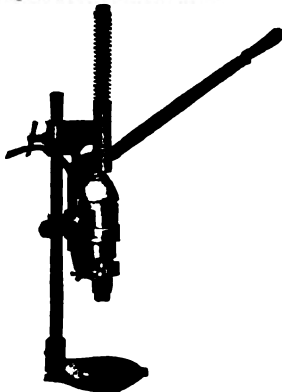


This ½-inch Drill with the Bench Drill Stand is indispensable in the shops of all plumbers, electricians, sheet-metal workers and contractors—automobile, aircraft, tire and battery repair shops—and all kinds of manufacturing plants from the smallest machine shop to the largest factory, for use in both maintenance and production work. Features include the powerful "Van Dorn" made motor, ball-bearing armature and spindle thrust, hardened alloy steel gears, and automatic safety switch. Equipped with combination spade and breast plat handle, three jaw chuck and 10 feet of cable with plug.

Specifications

Speed—540 R.P.M. no load.
Drilling Capacity—½ in.
Length—16½ inches.
Weight—15 pounds.
Code No. 8600. Price.....\$45.00
Furnished for 32, 110, 220 and 250 volts.
Operates on Direct or Alternating current.

Bench Drill Stands



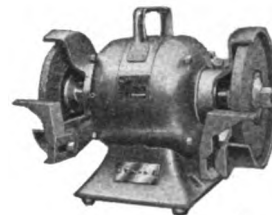
Code No. DS-500. Price.....\$18.00
For use only with Van Dorn ¼-inch Electric Drill. This Drill Stand increases the utility of the ¼-inch Drill by converting it into a VAN DORN POWERED Drill Press. A 4 to 1 leverage increases Drilling Speed. Drill can be quickly and easily removed from stand when needed for use as a portable tool.
Code No. 1295. Price.....\$28.00

Bench Drill Stand for ¾-inch, ½-inch, ¾-inch, ¾-inch and ¾-inch Electric Drills.
Code No. 1250. Price.....\$32.00

Post or Wall type Drill Stand for ¾-inch, ½-inch, ¾-inch, ¾-inch and ¾-inch Electric Drills.

6-inch Bench Grinder

A rugged, efficient utility bench grinder with power and long life built in by Van Dorn. Ideal for tool dressing, sharpening hand tools and light grinding of all kinds. Convenient handle makes this grinder easily portable and rubber pads on base eliminate necessity of bolting grinder to bench for light work. Priced within reach of even the smallest shop.



Specifications

Motor—Completely enclosed, split phase type with starting current to meet latest central station requirements. Operates from lighting circuit.
Bearings—Ball bearings with dust-proof housings.
Wheel Guards—Open-end Guards, with openings adjustable. Tool rests mounted on guards and adjustable to wear of wheel.
Equipment—Two 6"x ¼"x ¼" grinding wheels, wheel guards and tool rests, three-wire cable and plug.
Current—Supplied for 110 volt, 50/60 cycle alternating current only.
Weight—36 pounds.
Code No. G-200. Price.....\$35.00

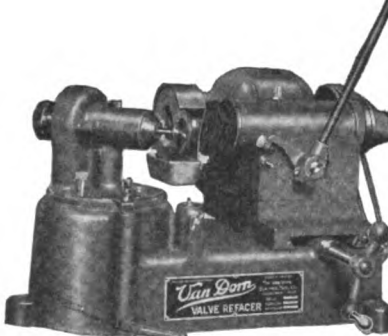
7-inch Ball Bearing Bench Grinder

A general purpose grinder for sharpening all kinds of edge tools. Dust-proof ball bearings insure troubleproof operation. Compact design takes up very little room on work bench or pedestal. Complete with two grinding wheels, adjustable tool rests, wheel guards, switch and cable ready for use.

Specifications

Size of wheels—7-inch diameter x ¼-inch face x ¼-inch hole.
Speed—3600 R.P.M. (60 cycle A. C. and D. C.)
Weight—50 pounds.
Specify voltage and current when ordering.
Code No. G-300. Price.....\$56.00

Valve Refacers



Van Dorn electric valve refacers have been designed and built to meet the great demand for a machine that will reface valves with absolute accuracy, with a capacity for a wide range of valve stems—and still have further uses, such as sharpening cutters, grinding rocker arms, etc. CONSTRUCTION FEATURES—Workhead and wheelhead belt driven. ¼-H.P. motor of the constant speed type insure the maintenance of proper grinding speed under load. The wheel shaft mounted on ball bearings. Van Dorn "Twin Grip" Collets

are the means of chucking valves with maximum of accuracy. Workhead can be rotated from 0 to 90 degrees, doweled and marked at popular settings.

VR-200 Valve Refacer

Capacity—¼ inch to ½ inch Valve Stems.
Angle Adjustment—0 to 90°.
Specify voltage, current and cycles when ordering.
Code No. VR-200. Price.....\$98.00

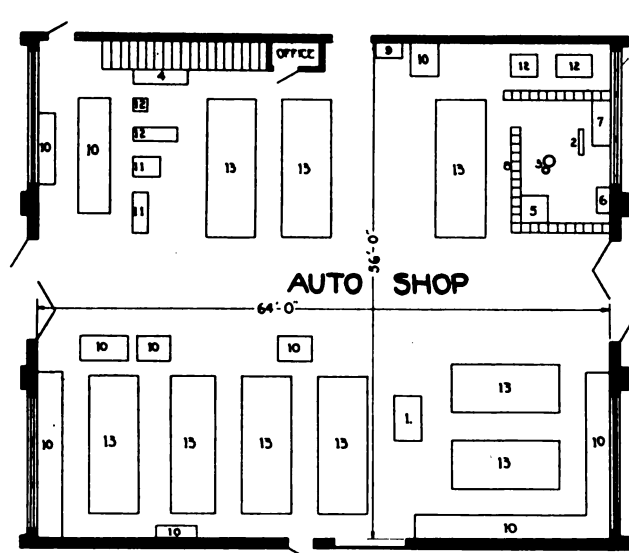
The Van Dorn Engine Kit

This Engine Kit contains all necessary equipment for cleaning carbon, reconditioning valve seats and testing valve grinding jobs. The kit is a strong compact metal box, with a definite place for each item of equipment. With the Van Dorn Valve Refacer, this Kit gives to the garage everything necessary for the complete Van Dorn METHOD. There is an assortment of Valve Guide Brushes, Valve Reseating Cutters, Valve Seat Hones and Expanding Pilots to handle a large majority of passenger cars and the powerful Van Dorn ¼-inch Heavy Duty Drill.

No. 52 Engine Kit, complete.
Price.....\$105.00

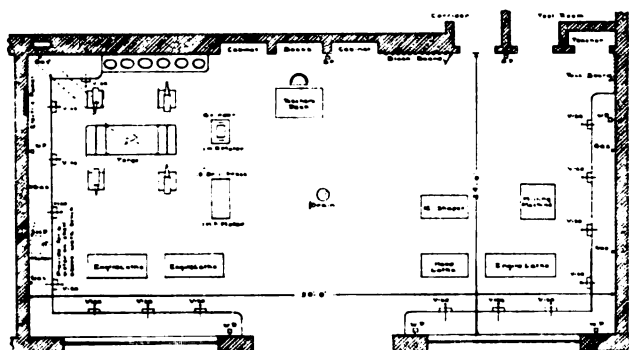
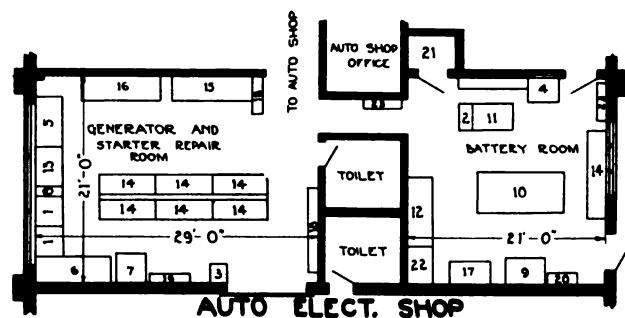


The Van Dorn Electric Tool Co. Cleveland, Ohio



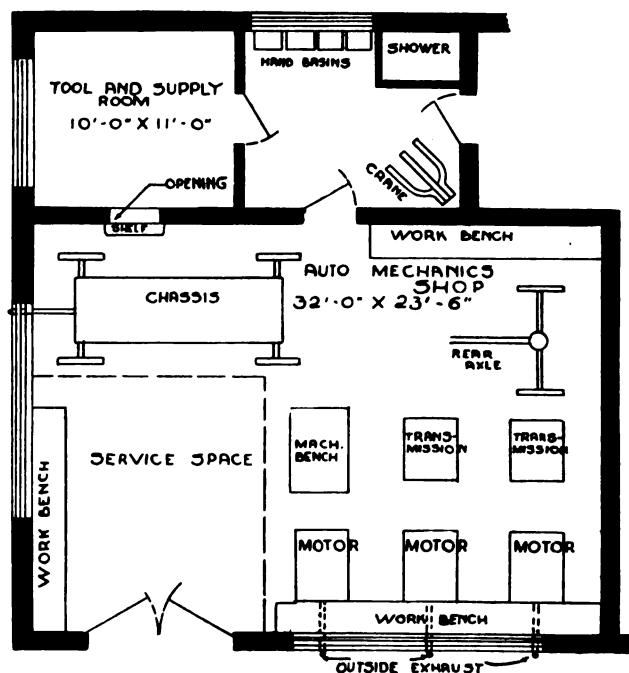
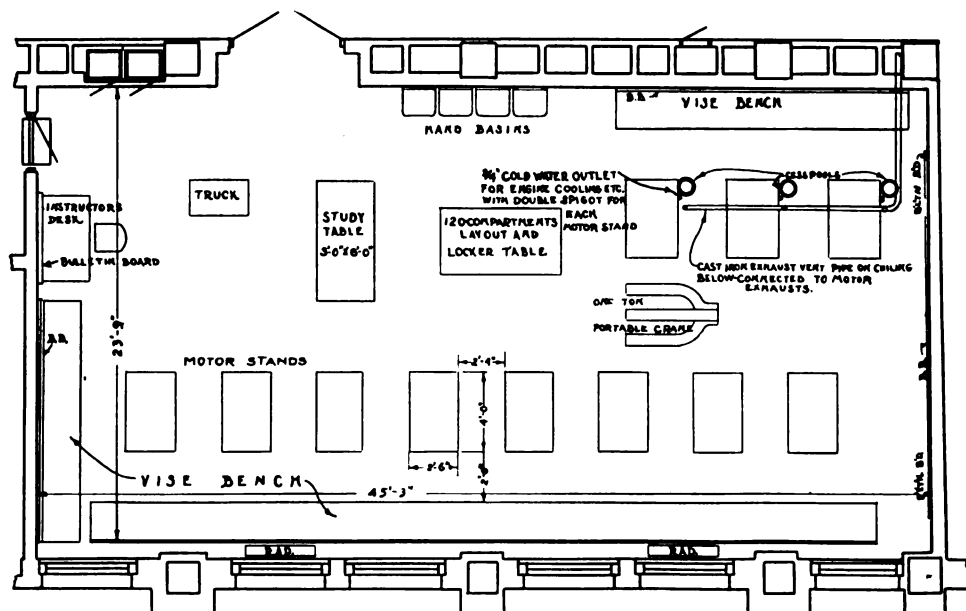
JOHN C. FREMONT HIGH SCHOOL, LOS ANGELES, CALIF.

- | | |
|-------------------------|-----------------------|
| 1. Hoist | 8. Lockers |
| 2. Press | 9. Foreman's Desk |
| 3. Acetylene Tank | 10. Benches |
| 4. Sink | 11. Airplane Motors |
| 5. Welding Table | 12. Automobile Motors |
| 6. Soldering Iron Shelf | 13. Cars |
| 7. Air Compressor | |

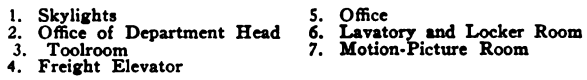
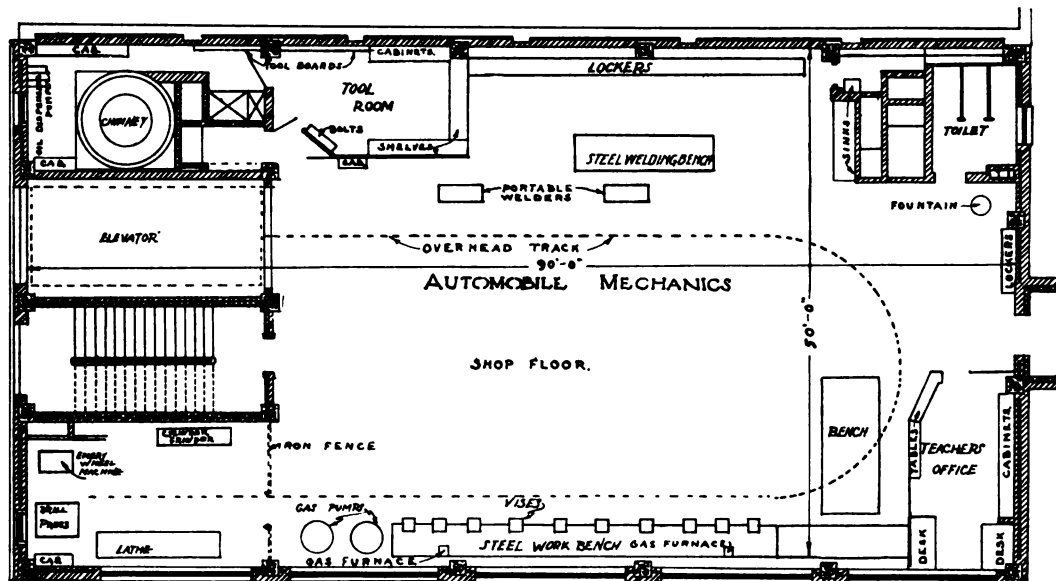
TYPICAL AUTO SHOP, SENIOR HIGH SCHOOLS,
DENVER, COLO.

JOHN C. FREMONT HIGH SCHOOL, LOS ANGELES, CALIF.

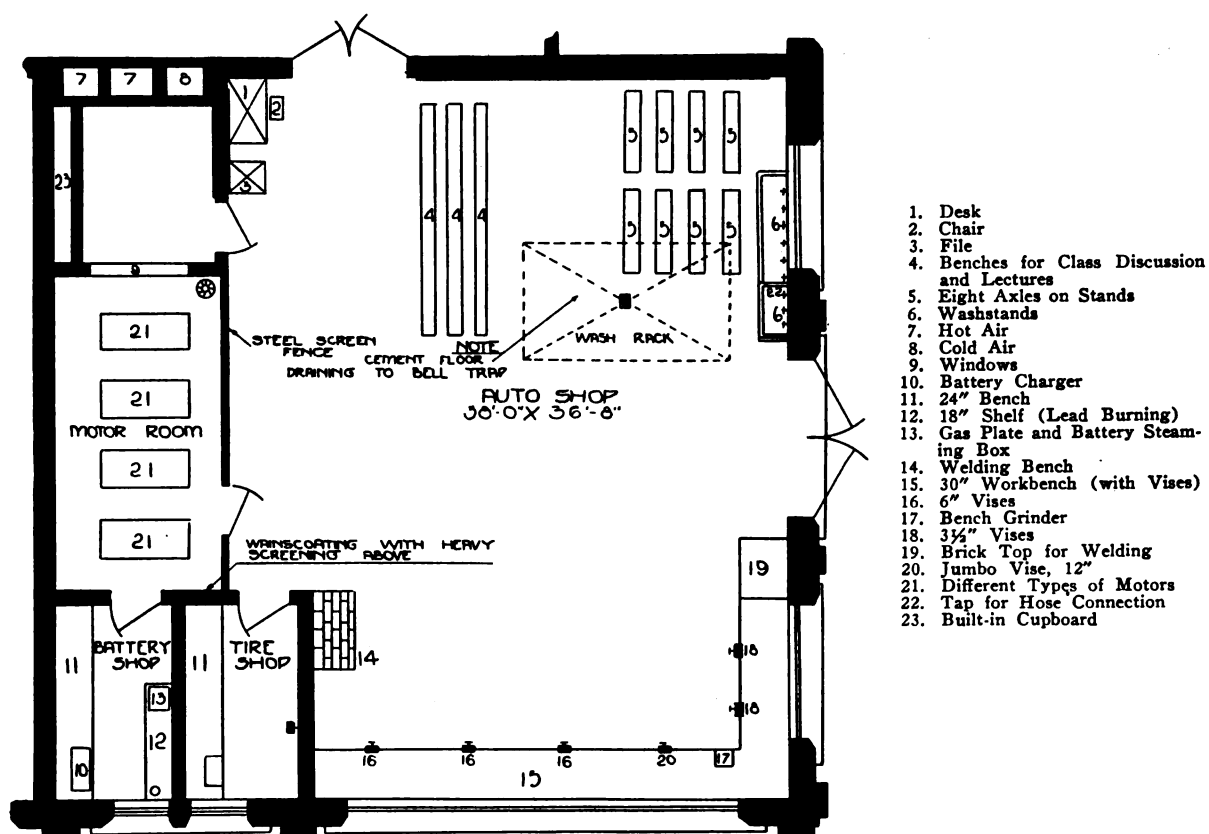
- | | |
|------------------------------------|----------------------------------------|
| 1. Bench Lathe, 3 1/2 x 16 | 13. Soldering Bench |
| 2. Motor Generator, 1 h.p. | 14. Repair Benches |
| 3. Grinder | 15. Tool and Supply Cabinet |
| 4. Breakdown Tester | 16. Starter, Gen. and Magnetic Cabinet |
| 5. Ford Coil Tester | 17. Separator Cabinet |
| 6. Coil, Spark and Magnetic Tester | 18. Lockers |
| 7. Generator and Starter Tester | 19. Switch Box Panel |
| 8. Gear Puller | 20. Steam Radiators |
| 9. Lead Molding Bench | 21. Closet |
| 10. Lead Burning Bench | 22. Sink |
| 11. Battery Charging Bench | 23. Battery Shelves |
| 12. Steaming Bench | |

AUTO-MECHANICS SHOP, ARMSTRONG HIGH SCHOOL,
RICHMOND, VA.

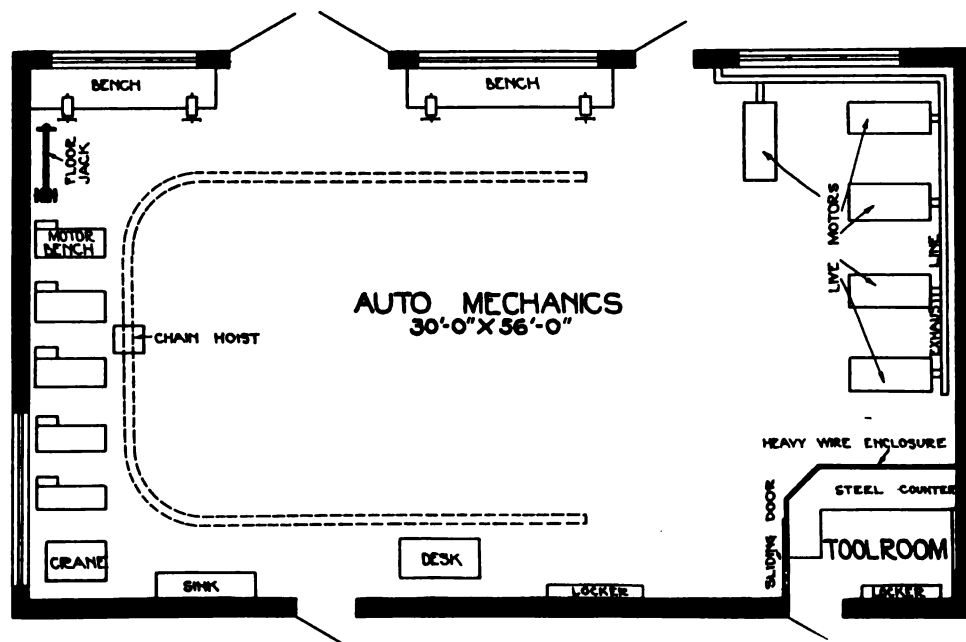
AUTO LABORATORY. SENIOR HIGH SCHOOL, PHILADELPHIA, PA.

[illegible]

BASEMENT AND FIRST-FLOOR PLAN
BOYS' TECHNICAL HIGH SCHOOL, MILWAUKEE, WIS.



AUTO SHOP, HAMTRAMCK VOCATIONAL SCHOOL, HAMTRAMCK, MICH.



LA CROSSE VOCATIONAL SCHOOL, LA CROSSE, WIS.

Auto-Mechanics Equipment

Major Equipment

15 to 20 Students Per Class

NOTE:

Class A is a tentative list for the automotive shop of (a) large technical high and full-time vocational schools, (b) large senior high schools, and (c) large part-time vocational schools.

Class B is for (a) small technical high schools, (b) small senior high schools, and (c) large junior high schools.

Class C is for small junior high schools.

Name and Description	Class A	Class B	Class C	Name and Description	Class A	Class B	Class C
Air Compressor	1	1	0	Drill			
Anvil, 100-lb.	1	1	0	Breast	1	1	1
Arbor Press				Hand	1	1	1
10-ton	0	1	0	Post, hand or power.....	1	1	1
20-ton	1	0	0	Portable electric	1	1	0
Armature Growler	1	1	0	First-Aid Cabinet and Supplies ...	1	1	1
Axle Stands				Forge, coal or gas, with hand- or			
Front	5	4	3	electric-driven blower	1	1	0
Rear	5	4	3	Funnels			
Axle-Repair Stands (Rear)	1	1	0	Lead	1	0	0
Battery				Tin	2	1	1
Charger, 15 battery.....	1	1	0	Gas Furnace	1	1	1
Clips, universal	24	18	0	Gas Stove	1	1	0
Discharge rack	1	1	0	Grease Gun			
Filler	1	1	1	Alemite	1	1	1
Opener	1	1	0	Zirk	1	0	0
Post builders, sets.....	1	1	0	Differential case	1	1	1
Separator trimmer	1	1	0	Grinder, bench, hand- or power-			
Thermometer	1	1	0	driven	1	1	1
Benches				Hydrometers	2	1	1
Electric test	1	1	0	Jacks			
Work, with vises.....	4	4	4	Plain	5	4	3
Blackboard, permanent or portable		1 or more		Roller	1	1	0
Blowtorch, 1-qt. size	1	1	1	Lathe			
Bookcase, for reference books,				12"	0	1	0
catalogs, etc.		1 or more		16"	1	0	0
Brazing Outfit	1	0	0	Lamps			
Bulletin Board		1 or more		Extension	4	3	2
Burning-In Machine	1	0	0	Test, 6-volt	3	2	1
Cans				Test, 12-volt	1	1	0
Differential grease, with force				Test, 110-volt	3	2	1
pump	1	1	0	Lead Burning			
Gasoline, 1-gal. size.....	2	2	1	Racks	8	6	0
Gasoline, 5-gal. size.....	1	1	0	Torches	12	8	0
Kerosene, 5-gal. size.....	1	1	1	Lead Pot	1	1	0
Oil, 5-gal. size.....	2	1	0	Magneto			
Oil, with pump.....	1	1	0	Recharger	1	1	0
Waste	2	2	1	Tester (Ford)	1	1	0
Cabinets, wood or metal, for filing				Molds			
class records, instruction sheets,				Battery post and nut.....	1	1	0
drawings, etc., or for tools and				Battery strap.....	1	1	0
supplies		1 or more		Burning stick.....	1	1	0
Chain Hoist, differential, duplex or				Lead hammer	1	1	0
triplex	1	1	1	Oil Tanks, with pumps	2	1	0
Chairs, tablet-arm, if needed for				Portable Electric Drill	1	1	0
the related-subjects room, or				Pouring Ladle	1	1	1
demonstration section	20	20	20	Power Unit (Electric Motor)	1	1	0
Chucks				Pressure Gauge for Oxygen Tank .	1	1	0
Drill, selected sizes, each.....	1	1	1	Regrinding Machine	1	0	0
Lathe, combination or independ-				Sealing-Compound Pots	1	1	0
ent, 4-jaw, selected sizes, each	1	1	0	Steel Stamp			
Connecting Rod				Neg. 3/8"	1	1	0
Aligning jig	1	0	0	Pos. 3/8"	1	1	0
Rebabbiting jig (Ford).....	1	1	0	Straightening Press	1	1	0
Compasses (Small)	2	1	0	Test Stand, for testing generators			
Creepers	4	3	1	and starting motors.....	1	0	0
Cell Volt Tester	1	1	0	Tool Kits	20	20	20
Crane				Transmission Tables	5	4	3
Overhead	1	0	0	Tube-Repair Kit	1	1	1
Portable	1	1	0	Vacuum-Tank Chart (Stewart) ...	1	1	1
Crankshaft Truing Device	1	1	0	Vises, machinist	12	8	8
Distilled-Water Tank	1	0	0	Volt Ammeters	4	2	1
Differential Stands	2	1	0	Welding Outfit, acetylene	1	0	0
Desk				Wire Brushes	4	4	4
Teacher's, with drawer compart-							
ments	1	1	1				
Chair to match desk.....	1	1	1				

Use post-card service for special information

Auto-Mechanics Equipment

Small Tools

15 to 20 Students Per Class

NOTE:

Class A is a tentative list for the automotive shop of (a) large technical high and full-time vocational schools, (b) large senior high schools, and (c) large part-time vocational schools.

Class B is for (a) small technical high schools, (b) small senior high schools, and (c) large junior high schools.

Class C is for small junior high schools.

Name and Description	Class A	Class B	Class C	Name and Description	Class A	Class B	Class C
Arbors				Pipe Taps, 1/8" and 1/4", each.....	1	1	0
Drill-Chuck, to suit requirements	2	1	1	Pliers			
Battery				Combination 6"	12	12	12
Jar pullers	2	1	0	Long-nose	2	2	2
Knives	4	2	0	Punches			
Taper-terminal reamer.....	1	1	0	Center, 1/4" and 3/8", each.....	3	3	1
Terminal tongs	2	1	0	Drift, sets	2	2	1
Tongs	2	1	0	Prick, 1/4"	2	2	1
Breast Drill	1	1	1	Reamers			
Brooms and Floor Brushes	4	4	4	Adjustable, automotive, with			
Bolt Cutter	1	1	0	pilots, sets	1	1	0
Calipers				Solid, selected sizes, each.....	1	1	0
Inside, 6"	2	1	1	Taper-pin, set	1	1	0
Outside, 6"	2	1	1	Scales			
Cans, Oil, 1/2-pt.	6	4	3	Steel, 6", graduated 1/16" to 1/8" ..	12	12	12
Chain-Repair Pliers	1	1	0	Steel, 12", graduated to hands....	2	2	2
Chisels				Scrapers			
Cape, 3/8" and 5/8", each.....	2	2	1	Bearing, sets	1	1	1
Cold, 3/8" and 3/4", each.....	2	2	2	Carbon, sets	1	1	1
Diamond-point, 3/8"	2	2	0	Scraping Knives	3	3	1
Round-nose, 1/4"	2	2	0	Screw Drivers, selected sizes, each	6	6	6
Combination Square, with hardened				Screw Extractors, set	1	1	1
head and blade, and protractor				Scribers	3	3	2
head, 12"	1	1	0	Snips, straight, 3" cut	1	1	1
Cotter-Pin Extractor	1	1	1	Soldering Coppers and handles,			
Crankshaft Lapping Fixture	1	0	0	1-lb size, pairs.....	2	2	1
Dividers, 6", pairs	1	1	0	Spindle-Bushing Removers (Ford)	1	1	0
Fabric Knives	3	1	0	Spring Spreader	1	1	1
File Cards	6	3	3	Steel Figures, 1/8", sets	1	1	1
Files				Steel Letters, 1/8", sets	1	1	1
Flat, 8" and 10", each.....	6	6	6	Surface Gauge	1	1	1
Half-round, 8" and 10", each....	3	3	1	Stitcher, for working fabric and			
Platinum points	3	3	1	rubber	1	0	0
Round, 6" and 8", each.....	3	3	1	Taps and Dies			
Fire Extinguishers	4	4	2	Holder, adjustable	1	1	0
First-Aid Cabinet and Supplies	1	1	1	Machine-screw, Nos. 6 to 18....	1	1	0
Gauges				S.A.E., 1/4" to 3/4", sets.....	1	1	0
Center	1	1	0	U.S.S., 1/4" to 3/4", sets.....	1	1	0
Depth	1	1	0	Tire Tools, sets	7	4	2
Screw-pitch, as selected, each...	1	1	0	Tool Holders, selected for lathe,			
Thickness	1	1	0	each	1	1	0
Tire-pressure	1	1	1	Twist Drills, selected sizes, each..	3	3	3
Goggles for Tool Grinding	3	2	2	Valve			
Gear Puller	1	1	1	Grinding outfits	3	3	3
Hack Saw				Reseaters	1	1	0
Adjustable frame	2	2	2	Seat reamers, sets.....	1	1	0
Blades, 18T, 10", doz.....	3	3	3	Spring lifters	3	3	3
Hammers				Wheel Puller (Ford)	1	1	1
Ball-peen, 4-oz.	2	2	2	Wrenches			
Ball-peen, 1 1/4-lb.	10	10	10	Adjustable, selected sizes, each.	2	2	1
Lead	3	3	2	Band (Ford).....	1	1	1
Riveting	2	2	2	Hub-cap (Ford).....	1	1	1
Sledge, 12-lb.	1	1	0	Ignition, sets	3	2	1
Sledge, 6-lb.	1	1	1	Monkey, 18"	1	1	0
Lathe Dogs, as selected, each	4	2	0	Pipe, 10" and 14", each.....	1	1	1
Micrometers				Rim-bolt (Universal).....	1	1	1
Inside, 2" to 6".....	1	1	0	S.A.E., 1/4"-1", sets.....	6	4	2
Outside, 1"	1	1	0	Sockets, sets	6	3	1
Outside, 2" to 6".....	1	1	0	Socket, (Ford) sets.....	1	1	1
Oilstone	1	1	1	Spark-plug, sets	1	1	1
				Special valve-tappet, sets.....	3	1	1
				U.S.S., 1/4"-7/8", sets.....	2	1	1

See classified directory for sources of supply

Automotive Equipment

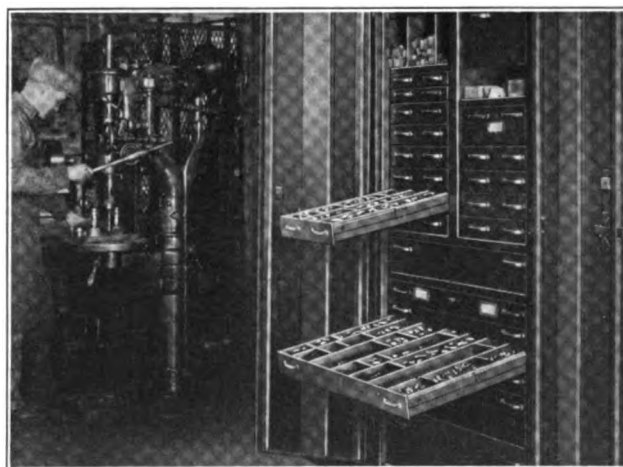
NOTE:

Class A is a tentative list for the automotive shop of (a) large technical high and full-time vocational schools, (b) large senior high schools, and (c) large part-time vocational schools.

Class B is for (a) small technical high schools, (b) small senior high schools, and (c) large junior high schools.

Class C is for small junior high schools.

Name and Description	Class A	Class B	Class C	Name and Description	Class A	Class B	Class C
Assembled Chassis	2	1	0	6-cyl. I head.....	1	1	1
Axles, Front				6-cyl. L head.....	1	1	0
Buick	1	0	0	Sleeve-valve	1	0	0
Chevrolet	1	1	1	Motor Stands			
Dodge	1	1	0	Regular type	5	4	3
Ford	1	1	1	Universal type	1	1	0
Studebaker	1	1	1	Regulators			
Axles, Rear				Combined voltage and current..	2	1	1
Buick	1	0	0	Current	2	1	0
Dodge, half-floating.....	1	1	0	Voltage	2	1	0
Ford, half-floating	1	1	1	Single-Cylinder Engine	1	1	0
Studebaker, $\frac{3}{4}$ -floating.....	1	1	1	Springs			
Tunken, full-floating	1	1	1	Cantilever	1	1	1
Battery-Ignition Systems				Ford	1	1	1
Atwater-Kent	1	1	0	Full elliptic	1	1	0
Atwater-Kent (Ford).....	1	1	1	$\frac{1}{2}$ elliptic	1	1	1
Auto-lite	1	1	0	$\frac{3}{4}$ elliptic	1	1	0
Bosch (Ford)	1	1	0	Starting Motors			
Connecticut	1	1	0	Auto-lite	1	1	0
Delco (4-cyl.).....	1	1	1	Bosch	1	0	0
Delco (6-cyl.).....	1	1	1	Delco	1	1	1
Delco (8-cyl.).....	1	1	0	Ford	1	1	1
Delco (Ford).....	1	0	0	Remy	1	1	0
Ford	1	1	1	Wagner	1	1	0
North East	1	1	0	Steering Mechanism			
Remy	1	1	0	Planetary (Ford).....	1	1	1
Wagner	1	0	0	Screw and nut.....	1	0	0
Carburetors				Screw and half nut.....	1	1	1
Air-valve type	2	1	1	Worm and sector.....	1	1	1
Compensating-jet type	2	1	1	Worm and wheel.....	1	1	1
Expanding type	2	1	0	Transmissions			
Metering-pin type	2	1	0	Brown-Lipe	1	0	0
Plain-tube type	2	1	1	Buick	1	1	1
Clutches				Chandler (Traffic).....	1	1	0
Borg and Beck (dry plate)....	1	1	1	Dodge	1	1	1
Cone	1	1	1	Ford (Planetary).....	1	1	1
Ford	1	1	1	Universal Joints			
Multiple disk	1	1	0	Steel	1	1	1
Wet plate	1	0	0	Thermoid	1	1	1
Cut-Out Relays	8	6	2				
Electric Horns	6	4	2				
Generators							
Auto-lite, 2-pole, or 4-pole.....	1	1	1				
Bijour, lap-wound, (2-brush and 4-brush)	1	0	0				
Bosch, 4-pole	1	0	0				
Delco motor generator.....	1	1	0				
Delco, wave-wound, or lap-wound, 2- or 4-brush.....	1	1	0				
Ford 3rd brush.....	1	1	1				
North East motor generator...	1	1	0				
Remy thermostat	1	1	0				
Lighting and Ignition Systems, mounted on tables	3	2	1				
Magnetos							
Dual type	1	1	1				
High-tension	1	1	1				
Inductor type	1	1	0				
Low-tension	1	1	0				
Shuttle type	1	1	0				
Motors							
Ford	1	1	1				
8-cyl. V head.....	1	0	0				
4-cyl. L head.....	1	1	1				



TOOLROOM CABINET WITH NARROW AND WIDE SLIDING DRAWERS WITH TILTING SUSPENSION

Use post-card service for special information

Auto-Mechanics Supplies

15 to 20 Students Per Class

NOTE:

Class A is a tentative list for the automotive shop of (a) large technical high and full-time vocational schools, (b) large senior high schools, and (c) large part-time vocational schools.

Class B is for (a) small technical high schools, (b) small senior high schools, and (c) large junior high schools.

Class C is for small junior high schools.

Name and Description	Class A	Class B	Class C	Name and Description	Class A	Class B	Class C
Acetylene Gas , in drums, for welding		As required		Wing, selected sizes, in lots of 100 each	1	1	0
Alcohol , gal.		As required		Oil			
Babbitt , lb.	50	50	50	Cylinder, light, medium, and heavy		As required	
Bearing Blue , tubes.....	6	4	4	600W		As required	
Bearing Compound , cans.....	6	4	2	Penetrating, pints	6	4	2
Bolts				Oxygen in drums for lead burning.		As required	
Machine, selected sizes, lots of 100 each	1	1	1	Pig Lead , lb.....	100	50	0
S.A.E., selected sizes, lots of 100 each	1	1	1	Piston-Ring Compressors	4	2	2
Stove, flat or round heads, selected sizes, in lots of 100 each	1	1	1	Radiator Hose		As required	
Brake Juice , ½-pint cans.....	6	3	0	Rivets , brake-linging, ⅜", ½", and ¾" long. Boxes of 100, each...	3	1	0
Brushes				Sandpaper , Nos. 00, 0, ½, and 1, quires each	5	3	2
Paint		As required		Screws			
Spark-plug	3	3	0	Flat-head or round-head, iron or brass. Selected sizes and kinds, per gross, each.....	1	1	1
Spoke	2	2	2	Cap and machine, iron or brass. Selected sizes and kinds, per hundred each	1	1	1
Steel	6	4	2	Set, head and headless.....		As required	
Varnish		As required		Shellac , ½-pt. cans.....	12	6	2
Chamois	3	3	3	Shim Stock		As required	
Coil-Spring Assortment	1	0	0	Soapstone , lb.	1	1	0
Copper Tubing		As required		Solder , bar, wire, or self-fluxing wire		As required	
Cotter Pins , assorted sizes, pkgs..	6	4	2	Soldering Paste		As required	
Crocus Cloth , quires.....	4	2	0	Spelter , for brazing, lb.....	10	0	0
Distilled Water , gal.....	5	3	0	Sponges , ½-lb. each.....	6	4	4
Drain Cocks		As required		Start Cable , ft.....	25	25	0
Electrolyte , carboy.....	1	0	0	Tacks, and Staples , for upholstery.		As required	
Emery Cloth , Nos. 00, 0, ½, and 1, quires each	5	3	2	Tire			
Enamel for Auto Painting		As required		Carcass fabric		As required	
Gaskets				Cushion stock		As required	
Copper asbestos		As required		Inner-tube repair stock.....		As required	
Cork and felt.....		As required		Patching cement		As required	
Flange		As required		Patches		As required	
Gasoline		As required		Putty		As required	
Grease , cup, cans.....	10	5	2	Tread stock		As required	
Kerosene		As required		Vulcanizing		As required	
Keys, Whitney , assorted.....		As selected		Valve-Grinding Compound , coarse and fine, 8-oz. cans.....	6	4	4
Lacquer , colors, qt.....		As required		Washers			
Lubricant , transmission		As required		Lock, assorted sizes.....		As required	
Nails and Brads		As required		Wrought iron		As required	
Nuts				Waste , lb.	50	25	25
S.A.E., castellated, square, hexagon. Selected sizes and kinds, lots of 100 each.....	1	1	1	Wire			
U.S.S., square and hexagon. Selected sizes and kinds, lots of 100 each.....	1	1	1	Primary, ft.....	75	75	0
Machine-screw , selected sizes, in lots of 100 each.....	1	1	0	Secondary, ft.....	50	50	0

See classified directory for sources of supply

Motor Tool Specialty Company

School Service and Educational Division

Sales Branches and Warehouses in 28 Principal Cities—Over 325 Salesmen General Offices, 14 E. Jackson Blvd., Chicago

Atlanta, Ga. 334 W. Peachtree St., N. W.
 Boston, Mass. 510 Cambridge St., Allston Dist.
 Brooklyn, N. Y. 420 Empire Blvd.
 Buffalo, N. Y. 1505 Main St.
 Chicago, Ill. 2025 Michigan Ave.
 Cleveland, Ohio. 6525 Euclid Ave.
 Dallas, Texas. 2809-11 Main St.
 Denver, Colo. 17 W. 13th Ave.
 Detroit, Mich. 4450 John "R" St.
 Indianapolis, Ind. 609 N. Illinois St.
 Kansas City, Mo. 2526 Grand Ave.
 Los Angeles, Calif. 460 Venice Boulevard.
 Milwaukee, Wis. 321 Mineral St.
 Minneapolis, Minn. 1218 Harmon Place

Exclusive Distributors for
SNAP-ON WRENCH CO.

Milwaukee, Wis.
BLUE POINT TOOL CO.

Milwaukee, Wis.
 and Associate Factories
 Manufacturers of

Montreal, Que., Can. 1008 La Gauchetiere St., West
 Newark, N. J. 429 Central Ave.
 New York, N. Y. 2721 Webster Ave.
 Omaha, Neb. 2210 Farnam St.
 Philadelphia, Pa. 1610 Fairmount Ave.
 Pittsburgh, Pa. 5620 Penn Ave.
 Richmond, Va. 603 W. Broad St.
 San Francisco, Calif. 280 Golden Gate Ave.
 Seattle, Wash. 707 E. Pine St.
 St. Louis, Mo. 2647 Washington Blvd.
 Toledo, Ohio. 1439 Jackson St.
 Toronto, Ont., Can. 54 Dundas St., West
 Vancouver, B. C., Can. 735 Pacific St.

Snap-On Socket Wrenches, Blue Point and Other Mechanics' Tools

The aim of every instructor in auto mechanics is naturally to employ, as nearly as possible, in the school shop, the same methods and equipment that are used in industry. This is obviously important, in order that the student shall be working under conditions as they actually exist in commercial practice.

Speed—with safety—is the keynote of modern production in the automobile industry, and the use of efficient, economical hand tools is an important factor. Slow, inefficient, unsafe hand tools have no place in modern shops and have been practically eliminated.

The automobile industry was first to adopt socket wrenches for the majority of nut turning operations. Not because socket wrenches are especially designed for automobile service, but because of their greater safety, speed and adaptability to the work. Their time saving and safety

features in repair, maintenance and assembly in other lines also have come to be recognized during the past several years and they are now rapidly coming into general use throughout all industry.

In the light of the above facts we made a survey of the hand tool equipment in many school shops in different parts of the country and gave careful study to their needs. We then selected from the complete lines of Snap-On wrenches, Blue Point and other hand tools, the tools especially adapted for school shops. With the tools we offer a plan of supply and of service which we believe the instructor of industrial arts and vocational education will consider as being of real and definite value to him in properly equipping his shop. It will enable him to obtain the most useful variety of the best quality equipment for any given amount of money he has to spend.

Snap-On-Wrenches

Snap-on
 INTERCHANGEABLE
 Socket Wrenches

Snap-On-Wrenches are used and recommended by more good mechanics in America than any other tools of their kind. The line consists of a complete

range of dependable socket wrenches, which are made to interchange on the various wrench handles and attachments. Any required type of socket wrench to fit hexagon and square nuts and cap screws of all sizes is thus provided at a very low cost per wrench.

Genuine Snap-On Wrenches and Blue Point Tools can only be purchased through Sales Branches listed above. A branch is always glad to send a salesman to a school immediately upon inquiry.

Details of Construction

Snap-On sockets are machined from solid bars of Chrome Vanadium or special alloy steels famous for toughness and durability. They are carefully broached to accurate size, tapered to thin walls for maximum efficiency in operation, and heat treated to give unlimited service. There is no comparison between the lasting qualities of a Snap-On and the ordinary makes of sockets. Snap-On handles are made from special analysis steel, correctly designed and perfectly balanced for free and speedy action. All units have a non-rust nickel finish. The illustration shows the way a Snap-On socket snaps on to a handle. The spring backed ball locks it firmly and the two ball stops on the shank hold it in place. The socket and handle fit so firmly that they are just as strong as if made in one piece. These features allow a mere handful of interchangeable wrench units to do the work of ten times as many one-piece wrenches, and cost but a fraction of what the ordinary solid type socket wrenches would cost. By application of this interchangeable principle to the various types of wrench handles, attachments, and complete range of hexagon and square sockets you can make an enormous number of useful wrenches which will reach, fit and turn nuts and bolts in all sorts of positions and hard to reach locations. Every Snap-On Unit is guaranteed against defects in workmanship and materials for one year from date of purchase.



Blue Point Tools

BLUE POINTS
 CHICAGO

Blue Point Open End and Tappet Wrenches, Punches, Chisels, Screw Drivers and other hand tools are com-

parable to Snap-On in quality and service. Their wide popularity in the industry is the highest possible recommendation for them. End wrenches are made of special analysis, manganese tool steel, tappet wrenches of Chrome Vanadium tool steel, and all carefully heat treated and finished. Blue Point punches and chisels are hammer forged from the finest Swedish tool steel and processed in such manner as to assure lasting quality and dependability.



Their Place in the School Shop

Snap-On-Wrenches and Blue Point tools find their greatest application in the school auto mechanics shop, though have a place in the school machine shop, sheet metal shop, electrical shop, wood shop and print shop.

A big source of tool loss in the school shop is the breakage of hand tools of inferior quality. They are also dangerous. Ill fitting wrenches slip, skinning knuckles, chisel and punch splinters fly about and endanger the boy's eyesight. Snap-On and Blue Point tools are made so sturdily that they can be used with safety by class after class. Cheap, inefficient wrenches are particularly detrimental to equipment, due to the rounding and chewing up of nuts and bolt heads as the machines are constantly torn down and then built up again. Snap-On sockets fit the nuts accurately on all sides and cannot damage them, nor slip off and injure the user, even on the hardest pull.

In the machine shop, Snap-On-Wrenches are particularly valuable when servicing machine tools. Blue Point tools find their greatest application in dependable and sure cutting bench tools.

In the wood shop, Snap-On Sockets are very adaptable, safe and handy when servicing woodworking machinery.

In the electrical shop, Snap-On Sockets tighten the fastenings of motors and dynamos safely and surely.

Motor Tool Specialty Company, 14 E. Jackson Blvd., Chicago

Motor Tool Specialty Company, Continued

The Snap-On School Shop Student Set

In recent years a number of progressive school systems have been experimenting with the idea of providing for every boy in the various school shops an individual tool kit. In most cases the idea has proved so successful that it has now been made permanent. The individual tool kit allows a better opportunity to stimulate self-reliance, care and appreciation of tools since it makes the individual student responsible for his tools. At the end of the school year the student's deposit on the tools is returned and if any loss has occurred a deduction is made to compensate for such loss.



Replacement Prices	
1-S-10 Sliding Tee and Offset.....	\$1.10
1-S-12 Extension Bar, 10".....	.85
6-Hexagon Sockets.....	2.30
	\$4.05
Strong metal case, black lacquer finish.....	\$1.00
	\$5.05
Special School price, when sold in lots of six or more sets and for educational purposes only, each.....	
	\$4.00

an extension bar which is used with the sliding tee to form an ell wrench or a long tee wrench. The six sockets that are most often used in the school shop are included and are made to interchange on these handles to give the boy thirty practical wrench combinations with these eight wrench units. School auto shop instructors have approved and considered this combination as solving a very perplexing and otherwise costly problem.



The Schoolshop Toolroom Set will be found particularly attractive when tools are checked in and out of a toolroom by means of the check system.

school shops use to the greatest extent. Additional units which the instructor finds a need for can be added as required. Set contains seventy-five units.

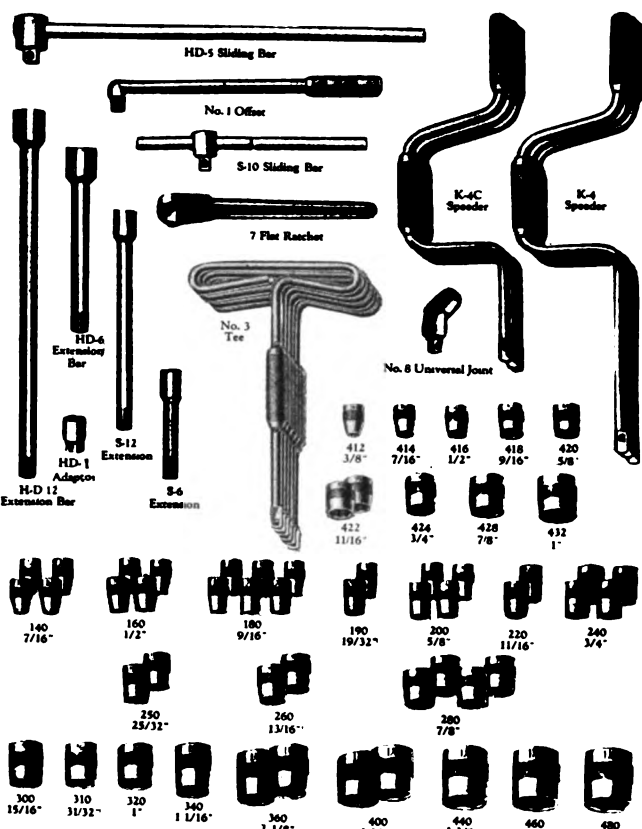
Genuine Snap-On Wrenches and Blue Point Tools can only be purchased through Sales Offices listed on page 187.

"Snap-On" has assisted automobile manufacturers for years in the making up of socket wrench sets appropriate for servicing their cars. Consequently until the "Snap-On" Wrench Co. determined upon an individual school set as a logical part of school shop student's kit, there have been available only such wrench sets that were primarily designed for the automobile factory, the automobile repair shop, and the automobile owner. We now offer an individual set designed especially for the school automobile shop student.

"Snap-On" School Shop Student Set consists of a combination offset and sliding tee handle, an extension bar which is used with the sliding tee to form an ell wrench or a long tee wrench. The six sockets that are most often used in the school shop are included and are made to interchange on these handles to give the boy thirty practical wrench combinations with these eight wrench units. School auto shop instructors have approved and considered this combination as solving a very perplexing and otherwise costly problem.

Snap-On School Shop Toolroom Assortment

A socket wrench set that possesses only one wrench handle of a kind when actually three to a half dozen are in demand at the same time does not serve the purpose. These were facts brought out in our school survey, and then we had school auto shop instructors experiment until an efficient combination of both handles and sockets was determined. In this specially selected assortment duplication has been made of those particular parts of the standard sets that the



Designed as a tool room set. Supplies complete socket wrench equipment.

Replacement Prices		Replacement Prices	
1-H.D.-5 Sliding Tee, 18".....	\$1.80	2-190, 1 1/4" Hex. Sockets.....	.35 .70
1-No. 1 Offset.....	1.00	4-200, 1 1/2" Hex. Sockets.....	.40 1.60
1-S-10 Sliding Tee.....	1.10	2-220, 1 3/8" Hex. Sockets.....	.40 .80
1-No. 7 Ratchet.....	3.00	4-240, 1 1/2" Hex. Sockets.....	.40 1.60
1-H.D.-12 Extension Bar, 16".....	1.55	2-250, 1 3/4" Hex. Sockets.....	.45 .90
1-H.D.-6 Extension Bar, 8".....	1.25	2-260, 1 3/8" Hex. Sockets.....	.45 .90
1-S-12 Extension Bar, 10".....	.65	4-280, 1 3/4" Hex. Sockets.....	.45 1.80
1-S-6 Extension Bar, 5".....	.60	1-300, 1 1/2" Hex. Socket.....	.50
1-H.D.-1 Adapter.....	.50	1-310, 1 1/4" Hex. Socket.....	.50
1-No. 8 Universal.....	1.65	1-320, 1 1/2" Hex. Socket.....	.50
3-K-4C Speeder, 15".....	\$1.35 4.05	1-340, 1 1/4" Hex. Socket.....	.65
3-K-4 Speeder, 19".....	1.35 4.05	2-360, 1 1/4" Hex. Sockets.....	.70 1.40
6-No. 3 Tee, 12".....	1.00 6.00	2-400, 1 1/4" Hex. Sockets.....	.70 1.40
1-412, 3/4" Sq. Socket.....	.30	1-440, 1 1/4" Hex. Socket.....	.80
1-414, 7/8" Sq. Socket.....	.30	1-460, 1 1/4" Hex. Socket.....	.80
1-416, 1" Sq. Socket.....	.35	1-480, 1 1/4" Hex. Socket.....	1.00
1-418, 1 1/8" Sq. Socket.....	.40		
1-420, 1 1/4" Sq. Socket.....	.40		
2-422, 1 1/2" Sq. Sockets.....	\$0.40 .80		
1-424, 1 3/4" Sq. Socket.....	.50		
1-428, 1 7/8" Sq. Socket.....	.50		
1-432, 1 7/8" Sq. Socket.....	.60		
4-140, 7/16" Hex. Sockets.....	.35 1.40		
4-160, 1/2" Hex. Sockets.....	.35 1.40		
6-180, 9/16" Hex. Sockets.....	.35 2.10		
			\$52.05

Special school price when used for educational purposes only.....\$39.00

Snap-On School Shop Toolroom Cabinet

This cabinet has been designed to hold a variety of Snap-On Sockets and Snap-On handles in a convenient and readily accessible arrangement. The instructor can by simply opening the drawers and the doors of the cabinet, readily check and immediately determine what items are missing. Price of cabinet when purchased with the above tool room equipment or any of the tool budgets on following pages. Each \$10.00.

All prices are subject to change without notice.

Write for complete catalog

Motor Tool Specialty Company, 14 E. Jackson Blvd., Chicago

Motor Tool Specialty Company, Continued

Tool Budget Plan

As a result of our school shop survey the following budgets are suggested in order to provide instructors and supervisors with a convenient means whereby Snap-On Wrenches and Blue Point tools can be made part of school shop equipment. Varying amounts of money are usually available. Snap-On equipment is such that you can start with a small set of handles and sockets and, in view of the interchangeable feature, keep adding new units as you need them. The fact that tools other than socket wrenches are also available enables you to have in your school shop a uniform outfit made by one factory, always up-to-date,

Twenty-five Dollar Budget No. 1

The following list of equipment will provide an outfit that will permit a small class in a small shop to work comfortably. The socket wrench equipment is based on what is known as the Master Service Set, with such Blue Point open end wrenches, tappet wrenches and other tools that are vitally necessary. The tools are as follows:

Quantity	Replacement Prices
1—Master Service Set, Snap-On Wrenches consisting of the following tools:	
1—No. 1 Offset.....	\$ 1.00
1—No. 10 Sliding Tee.....	1.10
1—No. 7 Ratchet.....	3.00
1—No. K-4, 19" Speeder.....	1.35
1—No. K-4-C, 15" Speeder.....	1.35
1—No. 3 Tee.....	1.00
1—No. S-6 Extension, 5".....	.60
1—No. S-12 Extension, 10".....	.65
10—Hex. Sockets, $\frac{1}{8}$ ", $\frac{1}{4}$ ", $\frac{3}{8}$ ", $\frac{1}{2}$ ", $\frac{5}{8}$ ", $\frac{3}{4}$ ", $1\frac{1}{8}$ ", $1\frac{1}{4}$ ", $1\frac{1}{2}$ ", and $1\frac{3}{4}$ " openings	3.95
No. 8 Universal joint.....	1.65
Master Service Set complete.....	\$15.65



Snap-On Universal Joint
Used with any handle and works freely at nearly a 90° angle. Included in Master Service Set.

Quantity	Replacement Prices
1—SW-1200 Set of hexagon sockets additional (see below)....	\$ 6.25
1—Set No. BPR-8 Open End wrenches as follows: $\frac{3}{4}$ ", $1\frac{1}{8}$ ", $1\frac{1}{4}$ ", $1\frac{1}{2}$ ", $1\frac{3}{4}$ ", $2\frac{1}{8}$ ", $2\frac{1}{4}$ ", $2\frac{1}{2}$ ", $2\frac{3}{4}$ ", $3\frac{1}{8}$ ", and $3\frac{1}{4}$ ".....	6.90
1—No. T-1820 Tappet wrench; $\frac{3}{4}$ " opening on straight end, $\frac{1}{2}$ " opening on angle end.....	.90
1—No. T-2018 Tappet wrench, with same openings reversed..	.90
1—No. 8 Adjustable wrenches, 8", at 80¢ each.....	.80
2—No. 6 Adjustable wrenches, 6".....	1.30
1—Blue Point Feeler Gauge.....	1.00
	\$33.70

Special School Price; sold as a Set—for educational purposes only 25.00



Blue Point Open End Wrench Set No. BPR-8
Eight wrenches for popular S. A. E. sizes from $\frac{3}{4}$ " to $1\frac{3}{4}$ " thread diameters.

Fifty Dollar Budget No. 2

This tool equipment is based on the School Shop Tool Room Set and a few of the most widely used Blue Point Tools.

Quantity	Replacement Prices
1—Snap-On School Shop Tool Room Set.....	\$52.05
1—No. BPR-8 Set Open End Wrenches (See Budget No. 1).....	6.90
1—No. T-1820 Tappet Wrench.....	.90
1—No. T-2018 Tappet Wrench.....	.90
1—No. SR-14 Chisel and Punch Set.....	6.75
	\$67.50

Special School Price, when sold as a Set—and for educational purposes only \$50.00

Fifty Dollar Alternative Budget No. 2-A

Quantity	Replacement Prices
1—Snap-On Master Service Set (See Budget No. 1).....	\$15.65
1—SW-1200 Set of hex. sockets additional..	6.25
1—No. BPR-8 Set Open End Wrenches.....	6.90
1—No. RA-1820 Wrench (See Budget No. 2).....	1.00
1—No. T-1820 Tappet Wrench (See No. 1).....	.90
1—No. T-2018 Tappet Wrench (See No. 1).....	.90
2—No. 8 Diamond Adjustable Wrenches, 8", at \$0.80.....	1.60
1—No. 10 Pipe Wrench, 10".....	1.45
1—47-A 7" Comb. Pliers.....	1.50
1—No. SR-14 Set Blue Point Chisels and Punches (See Budget No. 4).....	6.75
3—No. 181½ Screw Drivers (See No. 3-A).....	.75
3—No. 142 Screw Drivers (See No. 3-A).....	1.35
2—No. X-144 Screw Drivers (See No. 3-A).....	1.10
2—No. 8 Screw Drivers (See No. 3-A).....	3.00
1—No. 4-0 Ball Pean Hammers, 6 oz., at \$1.30.....	1.30
2—No. 2 Ball Pean Hammers, 1½ lbs. at \$1.55.....	3.10
1—No. A-2 Set Blue Point Two-way Gear Pullers.....	13.30
	\$66.80

Special School Price, when sold as a Set, and for educational purposes only \$50.00

SW-1200 Set, Extra Thin, Straight Walled Hexagon Sockets. Double broached. $\frac{7}{8}$ " to 1" openings.

Genuine Snap-On Wrenches and Blue Point Tools can only be purchased through Sales Offices listed on page 187.

guaranteed as to quality and backed by a national service which insures keeping your equipment always in perfect working condition.

The following budgets will allow the instructor to know just how he can allot to advantage the money allowed him. Seven different tool lists and some alternatives have been prepared.

In each instance the fact was kept uppermost that each list should constitute the best working equipment for the amount of money available.

Seventy-five Dollar Budget No. 3

This budget is based on the outfitting of twelve students with the Individual Students' Sets. This socket wrench equipment is supplemented by additional socket wrench equipment in order to provide complete nut turning service. The budget also provides for twelve pupils the tools necessary for an extensive course in auto mechanics. One alternative is offered substituting the Individual Sets for the School Shop Tool Room Set, with a subsequent change in other small tools available.

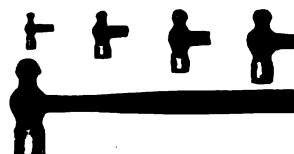
Quantity	Replacement Prices
12—Snap-On School Shop Students' Sets at \$5.05 (See preceding page).....	\$60.60
Additional Snap-On Wrench Units	
9—Sizes of Square Sockets, $\frac{3}{4}$ ", $1\frac{1}{8}$ ", $1\frac{1}{4}$ ", $1\frac{1}{2}$ ", $1\frac{3}{4}$ ", $2\frac{1}{8}$ ", $2\frac{1}{4}$ ", $2\frac{1}{2}$ ", $2\frac{3}{4}$ ", $3\frac{1}{8}$ ", $3\frac{1}{4}$ " openings No. 900 Set.....	3.70
1—No. 3 Tee.....	1.00
1—No. K-4 Speeder.....	1.35
1—No. 7 Ratchet.....	3.00
1—No. HD-1 Adaptor (For adapting Heavy Duty Sockets to standard handles).....	.50
1—No. 8 Universal.....	1.65
1—No. HD-5 Heavy Duty Sliding Tee, 18".....	1.80
1—No. HD-12 Heavy Duty Extension, 16".....	1.55
8—Heavy Duty Hexagon Sockets in the following sizes: $\frac{1}{8}$ ", $\frac{1}{4}$ ", $\frac{3}{8}$ ", $\frac{1}{2}$ ", $\frac{5}{8}$ ", $1\frac{1}{8}$ ", $1\frac{1}{4}$ ", $1\frac{1}{2}$ ", $1\frac{3}{4}$ " openings.....	5.15
	Blue Point Tools

2—No. 181½ Screw Drivers at \$0.25 (See Budget No. 3A)....	.50
2—No. X-144 Screw Drivers at \$0.55 (See Budget No. 3-A)....	1.10
1—No. 4-0 Ball Pean Hammer, 6 oz.....	1.30
1—No. 2 Ball Pean Hammer, 1½ lb.....	1.55
1—Set of 8 Open End Wrenches, including the following numbers and sizes: No. 1214 ($\frac{3}{4}$ "- $\frac{1}{2}$ "), No. 1416 ($\frac{1}{2}$ "- $\frac{3}{4}$ "), No. 1619 ($\frac{1}{2}$ "- $\frac{3}{4}$ "), No. 1820 ($\frac{3}{4}$ "- $\frac{1}{2}$ "), No. 2024 ($\frac{3}{4}$ "- $\frac{1}{2}$ "), No. 2225 ($\frac{1}{2}$ "- $\frac{3}{4}$ "), No. 2428 ($\frac{3}{4}$ "- $\frac{1}{2}$ "), No. 3236 ($1\frac{1}{8}$ "- $1\frac{1}{4}$ "), No. 2225 ($\frac{1}{2}$ "- $\frac{3}{4}$ "), No. 2428 ($\frac{3}{4}$ "- $\frac{1}{2}$ "), No. 3236 ($1\frac{1}{8}$ "- $1\frac{1}{4}$ "), No. T-1614 ($\frac{1}{2}$ "- $\frac{3}{4}$ "), No. T-1820 ($\frac{3}{4}$ "- $\frac{1}{2}$ "), No. T-2018 ($\frac{3}{4}$ "- $\frac{1}{2}$ "), No. T-2224 ($\frac{1}{2}$ "- $\frac{3}{4}$ "), No. T-2422 ($\frac{3}{4}$ "- $\frac{1}{2}$ "), No. T-2628 ($\frac{1}{2}$ "- $\frac{3}{4}$ "), No. T-2826 ($\frac{3}{4}$ "- $\frac{1}{2}$ ").....	8.15
	7.80
Special School Price, when sold as a Set—and for educational purposes only.....	\$100.70

Special School Price, when sold as a Set—and for educational purposes only 75.00



Right Angle wrenches
—Four wrenches, for close quarters—3 sizes.



Blue Point Ball Pean Hammers
—A quality line in twelve different weights from 2 oz. to 3 lbs.

Seventy-five Dollar Alternative Budget No. 3-A

Quantity	Replacement Prices
1—Snap-On School Shop Tool Room Set (See preceding page).....	\$ 52.05
1—No. 69 Snap-On Ferret Set (Illustrated on next page).....	14.75
1—Set of 9 Open End Wrenches, including the 8 numbers in budget No. 3, with the No. 1618 ($\frac{1}{2}$ "- $\frac{3}{4}$ ") wrench added.....	8.90
1—Set, 8 Tappet Wrenches (See Budget No. 3).....	7.80
3—No. 181½ Screw Drivers, blade 1½" long, $\frac{1}{4}$ " edge, at \$0.25.....	.75
3—No. 142 Screw Drivers, blade 2" long, $\frac{1}{4}$ " edge, at \$0.45.....	1.35
3—No. 8 Screw Drivers, solid shaft, blade 8" long, at \$1.50.....	4.50
3—No. X-144 Screw Drivers, solid shaft, blade 4" long, at \$0.55.....	1.65
2—No. 4-0 Ball Pean Hammers, 6 oz., at \$1.30.....	2.60
4—No. 2 Ball Pean Hammers, 1½ lbs., at \$1.55.....	6.20
1—No. 6 Diamond Adjustable Wrench, 6".....	.65
	\$101.20

Special School Price, when sold as a Set—and for educational purposes only \$75.00

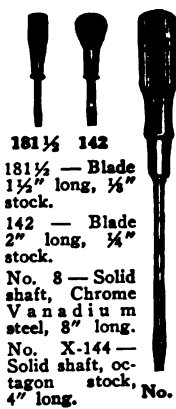
When studying budgets, use our standard catalog as a guide.

Double Broached Hexagon Sockets—Same general design as standard hex. sockets, but more practical where handle movement is limited.

Motor Tool Specialty Company, Continued

One Hundred Dollar Budget No. 4

This budget is based on eighteen students and primarily suggests the Individual Students Sets. Such other tools as are most used in the auto shop are included. One alternative list is offered.



181 1/2 142
181 1/2 — Blade
1 1/2" long, 1/4"
stock.
142 — Blade
2" long, 1/4"
stock.
No. 8 — Solid
shaft, Chrome
Vanadium
steel, 8" long.
No. X-144 —
Solid shaft, oc-
tagon stock,
4" long.

Quantity	Replacement Prices
18—Snap-On School Shop Student Sets	\$ 90.90
24—Additional Snap-On Wrench Units (See Budget No. 3)...	19.70
4—No. 181 1/2 Screw Drivers at \$0.25	1.00
4—No. 142 Screw Drivers at \$0.45	1.80
4—No. 8 Screw Drivers at \$1.50	6.00
4—No. X-144 Screw Drivers at \$0.55	2.20
2—No. 0-4 Hammers, 6 oz., at \$1.30	2.60
6—No. 2 Hammers, 1 1/2 lb. at \$1.55	9.30
	\$133.50

Special School Price, when sold as a Set—and for educational purposes only\$100.00

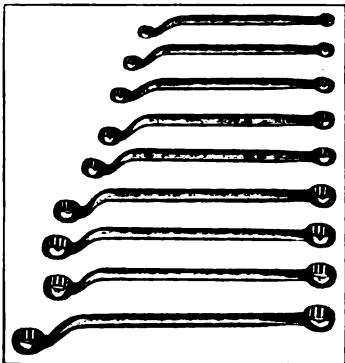
One Hundred Dollar Alternative Budget No. 4-A

Quantity	Replacement Prices
1—Snap-On School Shop Tool Room Set.....	\$2.05
1—No. SW-1200 Set Extra Thin Straight Walled Hexagon Sockets additional.....	6.25
1—Set of 8 Open End Wrenches (See Budget No. 3).....	8.15
1—Set of 8 Tappet Wrenches (See Budget No. 3).....	7.80
1—No. 1-6 Set, 6 sizes of Ignition Wrenches in kit bag.....	3.80
16—Screw Drivers (See Budget No. 4).....	11.00
8—Hammers (See Budget No. 4).....	11.90
1—No. 49 Pliers, 9" Adjustable Side Joint.....	2.25
1—Valve Tool.....	7.50
1—Blue Point Feeler Gauge.....	1.00
1—No. 2-A Set Blue Point Gear Pullers.....	13.30
1—SR-16 Set Blue Point Chisels and Punches, 16 assorted sizes, as illustrated.....	7.80
	\$132.80

Special School Price, when sold as a set—and for educational purposes only\$100.00

One Hundred Twenty-five Dollar Budget No. 5

This selection of tools includes the School Shop Tool Room Set, with additional hand tools necessary for a class consisting of twelve to fifteen students.



Blue Point Boxocket Wrenches—For hard to reach nuts. Long leverage, made of Chrome Vanadium steel.
No. X-9 Set — 1/4" to 1 1/2" double broached hexagon openings.

2—RB-10 Rivet Buster.....	1.80
1—No. 1658 Jimmy Bar, 16".....	1.25
1—No. 597 Special Valve Pin Plier.....	2.50
1—No. 197 Pliers, 7" Long Nosed at \$2.50	2.50
1—No. 49 Pliers, 9" Adjustable Side Joint at \$2.25	2.25
1—Set No. A-3, Three Way Gear Pullers	13.90
1—Set of 5 Snap-On Wheel Pullers (See illustration opposite).....	7.35
3—Blue Point Feeler Gauges at \$1.00..	3.00
	\$172.10

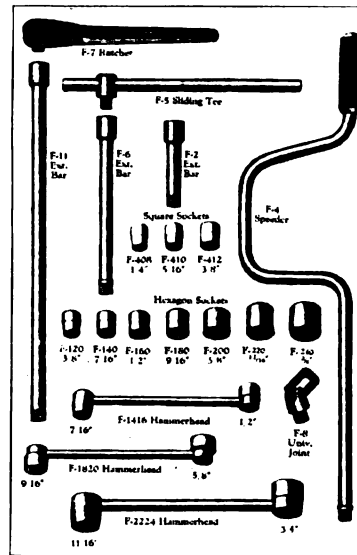
Special School Price, when sold as a Set—and for educational purposes only125.00

Quantity	Replacement Prices
1—Snap-On School Shop Tool Room Set.....	\$52.05
1—No. 69 Snap-On Ferret Set as illustrated.....	14.75
1—No. X-9 Set Boxocket Wrenches, as illustrated.....	16.80
1—Set Open End Wrenches (See Budget 3A).....	8.90
1—Set Tappet Wrenches (See Budget No. 3).....	7.80
1—No. 10 Pipe Wrench, 10".....	1.45
11—Screw Drivers, 3 No. 181 1/2; 3, No. 142; 3, No. X-144 and 2, No. 8.....	6.75
6—Hammers (See Budget No. 3-A).....	8.80
2—Blue Point Valve Grinders at \$3.85..	7.70
1—No. SR-16 Set Chisels and Punches, as illustrated.....	7.80



Snap-On Wheel Pullers, an improved and exceptionally efficient type of puller, simple in operation, made in 5 sizes for all popular makes of cars.

One Hundred Twenty-Five Dollars Alternative Budget No. 5-A



No. 69 Snap-On Ferret Set
Used—like the ferret—for going in after the hidden ones. An exclusive Snap-On design—makes quick, easy work of the many jobs in very cramped places on present day cars. Extremely thin-walled, shallow sockets and slender handles, but tremendously strong, made of Chrome Vanadium steel.

Quantity	Replacement Prices
12—School Shop Students' Sets at \$5.05.....	\$ 60.60
24—Additional Snap-On Wrench Units (See Budget No. 3).....	19.70
1—Set Open End Wrenches (See Budget No. 1)...	8.90
1—Set Tappet Wrenches (See Budget No. 3)...	7.80
11—Screw Drivers (See Budget No. 5).....	6.75
6—Hammers (See Budget No. 3-A).....	8.80
1—No. SR-16 Set Chisels and Punches, as illustrated opposite...	7.80
1—No. 69 Snap-On Ferret Set, as illustrated.....	14.75
1—No. 1-6 Set Ignition and Carburetor Wrenches—6 required sizes	3.60
1—Blue Point Valve Grinders at \$3.85..	3.85
1—No. 386 Diagonal Cutting Pliers.....	1.65
2—No. 197 Pliers, 7" Long Nosed at \$2.50.....	5.00
1—No. 49 Pliers, 9" Adjustable Side Joint.....	2.25
1—No. A-3 Set Three-Way Gear Pullers.....	13.90
	\$165.55

Special School Price, when sold as a Set—and for educational purposes only125.00

Genuine Snap-On Wrenches and Blue Point Tools can only be purchased through Sales Offices listed on page 187.

One Hundred Fifty Dollar Budget No. 6

This budget is based on the requirements of twenty students in a shop with an extensive project range. It is based on the School Shop Tool Room Set, together with additional Blue Point tools and also added socket wrenches to provide complete nut turning service.

Quantity	Replacement Prices
1—Snap-On School Shop Tool Room Set.....	\$ 52.05
1—No. 69 Snap-On Ferret Set, as illustrated.....	14.75
1—No. SW-1200 Set of Extra Thin, Straight Walled Hexagon Sockets, 12 sizes (See preceding page).....	6.25
1—No. 404 Set Snap-On Flexible Sockets, 5 most used sizes.....	7.50
1—No. BPR-8 Set Open End Wrenches (See Budget No. 1)....	6.90
1—No. BT-8 Tappet Wrenches (See Budget No. 3).....	7.80
2—Pipe Wrenches (See Budget No. 7).....	3.40
4—Diamond Adjustable Wrenches, 6" at \$0.65.....	2.60
4—Diamond Adjustable Wrenches, 8" at \$0.80.....	3.20
1—No. X-9 Set of 9 Boxocket Wrenches, as illustrated.....	16.80
11—Screw Drivers (See Budget No. 5).....	6.75

8—Hammers (See Budget No. 4).....	11.90
2—No. SR-16 Chisel and Punch Sets, 16 asstd. styles ea., at \$7.80	15.60
1—No. RB-10 Rivet Buster, 10".....	.90
1—No. 1658 Jimmy Bar, 16".....	1.25
2—Valve Grinders at \$3.85.....	7.70
5—Pliers (See Budget No. 5).....	12.00
2—Feeler Gauges at \$1.00.....	2.00
1—Set of 5 Snap-On Wheel Pullers (See Budget No. 5).....	7.35
1—No. 2-A Set Blue Point Two-Gear Pullers.....	13.30
	\$200.00

Special School Price, when sold as a Set—and for educational purposes only150.00

All prices are subject to change without notice.

When studying Budgets, Use Our Standard Catalog as a Guide

Motor Tool Specialty Company, 14 E. Jackson Blvd., Chicago

Motor Tool Specialty Company, Continued

One Hundred Fifty Dollar Alternative Budget No. 6-A

Quantity	Replacement Prices
20—Snap-On School Shop Students' Sets at \$5.05.....	\$101.00
24—Additional Snap-On Wrench Units (See Budget No. 3).....	19.70
1—No. X-9 Set Boxsocket Wrenches, as illustrated.....	16.80
1—Set Open End Wrenches (See Budget No. 3A).....	8.90
1—Set Tappet Wrenches (See Budget No. 3).....	7.80
16—Screw Drivers (See Budget No. 4).....	11.00
8—Hammers (See Budget No. 4).....	11.90
1—No. 597 Special Valve Pin Plier.....	2.50
1—Set No. SR-14 Chisels and Punches (See Budget No. 5).....	6.75
1—No. A-3 Set Blue Point Gear Pullers.....	13.90

Special School Price, when sold as a Set, and for educational purposes only..... \$200.25
150.00

Two Hundred Fifty Dollar Budget No. 7

This selection of tools is based on the use of the individual Socket Sets by students, with additional equipment designed to meet every situation calling for the use of a socket wrench. The Blue Point Tools included are as complete an assortment of hand tools as we believe necessary for the school shop.



No. BT-8 Tappet Wrench Set. A practical assortment of most popular sizes. Made to the specifications of expert mechanics.

Quantity	Replacement Prices
20—Snap-On School Shop Students' Sets, at \$5.05.....	\$101.00
Additional Snap-On Equipment	
1—No. SW-1200 Set of Extra Thin Straight Walled Hexagon Sockets, as illustrated.....	6.25
1—Set of 4 Spark Plug Sockets, Extra deep, sizes $\frac{7}{8}$ ", $1\frac{1}{8}$ ", and $1\frac{1}{4}$ ".....	4.30
9—Hexagon Sockets, large sizes, for use on standard handles, 3 each with $\frac{11}{16}$ ", $\frac{1}{2}$ " and $1\frac{1}{8}$ " openings at \$0.50.....	4.50
1—No. 404 Set Flexible Sockets, 5 most used sizes.....	7.50
1—No. 900 Set Square Sockets (See Budget No. 3).....	3.70
1—Set Heavy Duty Hexagon Sockets (See Budget No. 3).....	5.15
1—No. 608 Set Drain Plug Sockets, complete range of 8 sizes.....	3.55
2—No. 1 Offset.....	2.00
2—No. 7 Ratchet.....	6.00
3—No. 3 Tees at \$1.00.....	3.00
3—No. K-4 Speeders, 19" at \$1.35.....	4.05



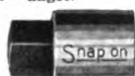
No. 55 Snap-On Midget Set
This little set contains 6 hexagon sockets with openings from $\frac{1}{4}$ " to $\frac{7}{16}$ ", 2 square sockets, $\frac{1}{4}$ " and $\frac{5}{16}$ " with a speeder tee and sliding tee and offset handle. Handy wrenches for the smallest nuts and bolts on ignition, carburetor, radio and all small electrical bench work.

1—No. LTP-4, Set of 4 Long Tapered Punches.....	2.45
1—No. RA-4 Set Right Angle Wrenches.....	4.40
1—No. 1-6 Set of 6 Ignition and Carburetor Wrenches.....	3.60
1—No. 10 Pipe Wrench, 10".....	1.45
1—No. 14 Pipe Wrench, 14".....	1.95
2—No. 4 Adjustable Wrenches, 4" at \$0.65.....	1.30
8—No. 6 Adjustable Wrenches, 6" at \$0.65.....	5.20
2—No. 8 Adjustable Wrenches, 8" at \$0.80.....	1.60
1—No. A-1 Set Gear Pullers, 2-Way and 3-Way hook-ups, as illustrated.....	17.40
1—No. 27 7" Special Thin Nose Pliers.....	1.75
	\$333.15

Special School Price, when sold as a Set—and for educational purposes only..... 250.00



Snap-On Flexible Sockets
Work freely at nearly a 90° angle.



Crank Case Drain Plug Sockets

Make quick work of oil draining jobs on cars having drain plugs with square female openings. Made with square male ends in 8 required sizes. No. 608 Set includes all 8 sizes.

Two Hundred Fifty Dollar Alternative Budget No. 7-A

Quantity	Replacement Prices
1—School Shop Tool Room Set.....	\$ 52.05
Additional Snap-On Equipment	
1—No. 7 Ratchet.....	3.00
2—No. 10 Hinged Offset and Tee Handles.....	5.00
1—No. HD-1 Adaptor.....	.50
1—No. DH-1000 Set Double Broached Hex. Sockets, 10 sizes, $\frac{1}{4}$ " to $\frac{1}{2}$ ", as illustrated opposite Budget No. 3-A.....	3.95
1—No. SW-1200 Set Extra Thin Straight Walled Sockets, 12 sizes, $\frac{1}{4}$ " to $1\frac{1}{8}$ ", as illustrated opposite Budget No. 2.....	6.25
1—No. V-21 Snap-on Valve Clearance Adjusting Tool, with 3 Sockets.....	2.50
1—Set of 4 Extra Deep Spark Plug Sockets, $\frac{7}{8}$ ", $1\frac{1}{8}$ ", $1\frac{1}{4}$ " and $1\frac{1}{2}$ " double broached hex. openings.....	4.30
1—No. 404 Set Flexible Sockets, 5 sizes (See illustration).....	7.50
4—No. S-9001 Ford Connecting Rod Sockets at \$0.50.....	2.00
2—No. A-16 Wing Nut Sockets.....	1.50
2—No. A-17 — Drag Link Adjusting Sockets, 1" blade, at \$0.60.....	1.20
1—No. 608 Set Drain Plug Sockets, 8 sizes, as illustrated.....	3.55
1—No. 69 Ferret Sets, as illustrated.....	14.75
2—No. F-2224 Ferret Hammerhead Wrench— $\frac{11}{16}$ " and $\frac{1}{2}$ " openings.....	2.20
2—No. F-8 Ferret Universal Joints.....	3.00
1—No. 55 Midget Wrench Set, as illustrated.....	2.75
Blue Point Tools	
1—No. XS-5 Set Dwarf Boxsocket Wrenches.....	6.15
2—Sets No. X-9 Boxsocket Wrenches at \$16.80, as illustrated.....	33.60
3—No. BPR-8 Sets Open End Wrenches at \$6.90 (See Budget No. 1).....	20.70
2—No. BT-8 Sets Tappet Wrenches at \$7.80, as illustrated.....	15.60
2—No. RA-4 Sets, Right Angle Wrenches, as illustrated.....	8.80



Complete No. A-1 Set of Blue Point Gear Pullers. Both 2-way and 3-way hook-ups. Handle more jobs efficiently than any other gear pullers made.

Spraker Valve Seat Reamer Set. Renewable blades—like a safety razor. No resharpening—very economical and efficient.



Vacuum Grip Pliers
Forged from special electric furnace tool steel and Swedish steel. Individually hardened and tempered in oil. Will stand up under severest strain without springing jaws. Guaranteed without restriction to give satisfactory service. Made in all styles.

1—No. I-8 Set of 8 Double End Midget Ignition Wrenches.....	4.80
2—No. 10 Pipe Wrenches, 10" size, at \$1.45.....	2.90
1—No. 14 Pipe Wrench, 14" size.....	1.95
1—No. E-10 Pipe Wrench, end type.....	1.45
2—No. 10 Diamond, Adjustable Wrenches, 10", at \$1.00.....	2.00
2—No. SR-16 Sets Chisels and Punches, providing 32 assorted sizes and styles.....	15.60
2—No. 1832 Long Flat Chisels, 18", at \$1.85.....	3.70
2—No. RB-10 Rivet Busters at \$0.90.....	1.80
2—Jimmy Bars at \$1.25.....	2.50
16—Screw Drivers (See Budget No. 4).....	11.00
8—Hammers (See Budget No. 4).....	11.90
1—No. A-1 Set Gear Pullers, illustrated.....	17.40
5—Snap-On Wheel Pullers (See Budget No. 5).....	7.35
5—Blue Point Feeler Gauges at \$1.00.....	5.00
1—No. 1 Set Spraker Valve Seat Reamers, as illustrated.....	25.00
2—Blue Point Valve Grinders at \$3.85.....	7.70
1—Snap-On Stud Remover.....	1.25
2—No. 597 Special Valve Pin Pliers at \$2.50.....	5.00
1—No. 197 Needle Nose Pliers, with cutter, 7" length.....	2.50
1—No. 49 Adjustable Side Joint Pliers, Heavy Duty pattern, 9".....	2.25
	\$333.90

Special School Price, when sold as a Set—and for educational purposes only..... 250.00

Additional Budget will be supplied upon request.

In studying budgets, use our standard catalog as a guide.

Genuine Snap-On Wrenches and Blue Point Tools can only be purchased through Sales Offices listed on page 187.

Motor Tool Specialty Company, 14 E. Jackson Blvd., Chicago

James Clark, Jr., Electric Company

600-640 E. Bergman St., Louisville, Kentucky

Manufacturers of

Clark Electrically Driven Tools

For Vocational Schools

After 29 years of successful use in a great many Vocational Schools Clark's Electrically Driven Tools are a recognized standard. They are no longer an experiment. To teach the Student to use the tool he will later in life be required to daily operate is



now a necessity. The six "Clark" tools illustrated below are used in many industries.

Write for Clark's New 1930 Catalog and prices on their complete line of Electrically Driven Tools.

"Clark's" 1/4-Inch Wonder Drill



1/4 inch Wonder Drill
Nonstallable
Code Word "Wonder"

Clark's 1/4" "Wonder Drill," Powerful, Light in Weight, and Compact, is needed in the Sheet Metal, Machine and Woodworking Shops of all Vocational Schools. Nonstallable. Code Word "Wonder."

Capacity of Chuck..... 1/4 in.
Length over all..... 7 1/2 in.
Offset of Drill from edge of frame..... 1 1/2 in.
No Load Speed..... 2000 r.p.m.
Loaded Speed..... 1200 r.p.m.
Weight..... 4 1/2 lbs.
Locking device supplied for continuous running if desired.

"Clark" Friction Driven Sensitive Drill



Clark's Bench and Floor Type Sensitive Drills of 1/2" and 3/8" capacity are admirably adapted to use in the various departments of any Vocational School. Their entire construction embodies features which teach the students the value of design, construction, serviceability and accuracy.

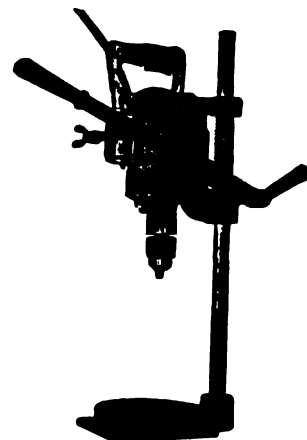
"Clark" Special Pattern Maker's Grinder

For the woodworking shop Clark's Special Pattern Maker's Grinder is indispensable. Being equipped with a 14" Disc Sanding wheel and a 12"x1" Grinding Wheel, the instructor is not only in a position to train the Student in the art of grinding his tools, but in the sanding of wood. Especially valuable in pattern making. The tilting table is adjustable and complete with indicator dial.



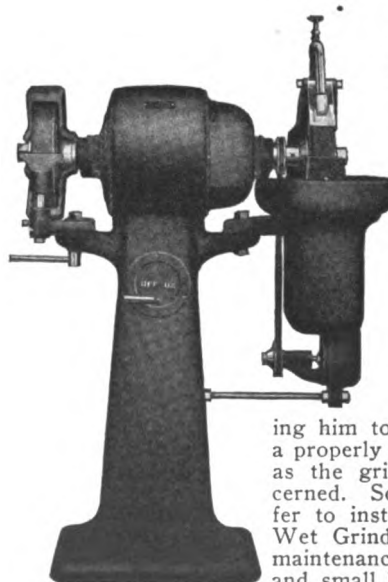
"Clark" No. 0 Drill Stand

Any of "Clark's" family of Automatic Portable Drills are adaptable to Clark's No. 0 Drill Stand, thereby making a "Two-in-One" Combination. When drill is removed from stand it serves for all kinds of portable work. Secured in the stand it meets the requirements of a small drill press, making accurate drilling possible. Automatic drills are built for 5 sizes of bits, 1/8", 1/4", 3/8", 1/2" and 5/8".



"Clark" Combined Wet and Dry Grinder

One of the best tools "Clark" builds for use in Vocational Schools is the Combination Wet and Dry Grinder. The Student is taught the art of sharpening tools on the wet wheel, thereby effecting a saving for the School Board in replacement of tools. After he has learned to successfully grind a tool without burning it, the Instructor passes him on to the dry wheel, where his training is completed, thus sending



him to the commercial world a properly trained mechanic as far as the grinding of tools is concerned. Some school boards prefer to install "Clark's" altogether Wet Grinders in order to reduce maintenance costs on bits, chisels and small hand tools.

"Clark" Tool Post Grinder



To do good lathe work, it is necessary that lathe centers be kept in proper condition. Clark's tool post grinder is just the tool for this purpose. To do this all that is necessary is to clamp the grinder in the tool post of lathe and grind each center in the revolving head. It can also be used for so many other operations that its value in a Vocational School is inestimable. The swivel shank enables the student to accomplish many

operations that cannot be done with grinders embodying stationary ones only. The internal attachment also adds to the value of the grinder. This tool can be supplied with or without hand feed.

James Clark, Jr., Electric Company, 600-640 E. Bergman St., Louisville, Kentucky

South Bend Lathe Works

Established in 1906—More Than 47000 Lathes in Use

701 East Madison Street South Bend, Indiana

Manufacturers of

South Bend Lathes

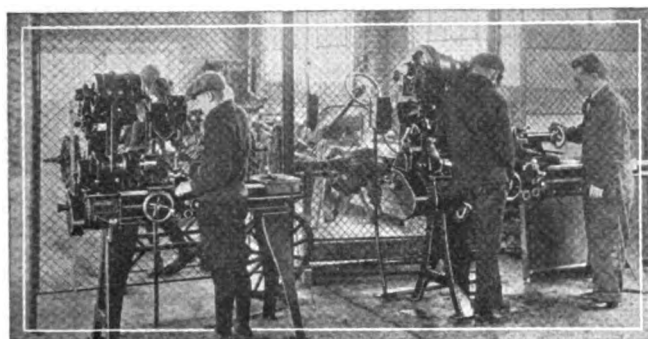
The Auto Mechanics Department is one of the most important of the entire school because the automotive industry is the largest industry in the United States. It employs more men and demands more skilled and trained mechanics than any other single industry. It is very important that the Auto Mechanics Department be equipped with a modern back geared, screw cutting

lathe on which the fine, accurate parts that are used in the modern automobile can be machined.

Automobile manufacturers recommend the screw cutting lathes for their service stations—one large machine for the heavy work and a smaller lathe for the light repair and electrical work, and the school shop should have the same equipment.



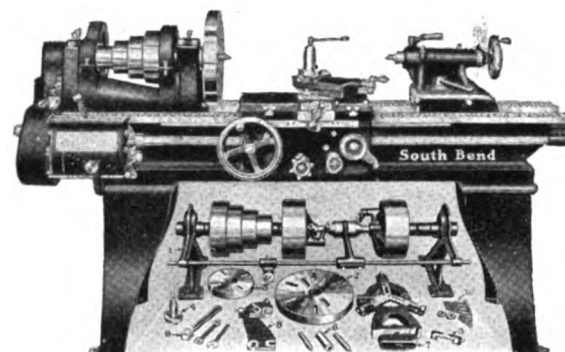
The Auto Mechanics Department of the Grand Island, Nebraska, School. This school shop takes in cars direct from the road, operating the same as a commercial shop, charges commercial prices, and is practically self-sustaining.



The illustration shows two lathes in the Auto Shop of the Logansport, Indiana, High School. One lathe is the 11" size, the other the 15" size. This school teaches every phase of automobile mechanics and covers every make of automobile.

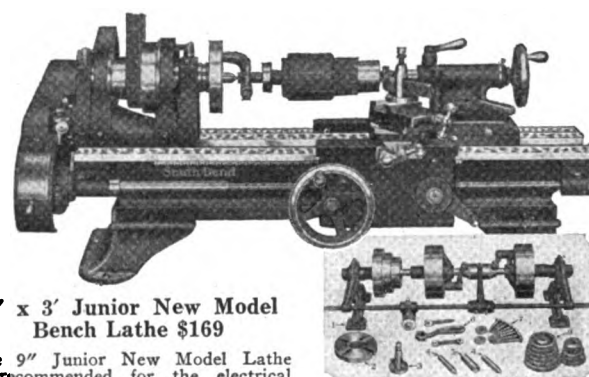


The illustration shows the Auto Mechanics Shop of the South Bend, Indiana, Vocational School. Over 400 schools throughout the United States are equipped with South Bend Lathes for handling Auto Mechanics Work.



16" x 8' New Model Quick Change Gear Lathe \$638

This lathe is recommended for commercial car servicing and for the Auto Mechanics Department of the school. It handles all parts of the modern automobile except the assembled wheel. It may be furnished in Countershaft Driven Type or Motor Driven Type, and may also be fitted with Taper Attachment, Milling Attachment, Grinding Attachment, Chucks, etc.



9" x 3' Junior New Model Bench Lathe \$169

The 9" Junior New Model Lathe is recommended for the electrical shop and for handling small work in the Auto Mechanics Department, such as valves, bushings, pistons, small pins, commutators, etc. Has back geared head stock, graduated compound rest, set-over tail stock for taper turning, power feed, cuts threads 4 to 40 per inch, recommended by twelve automobile manufacturers for service station use.



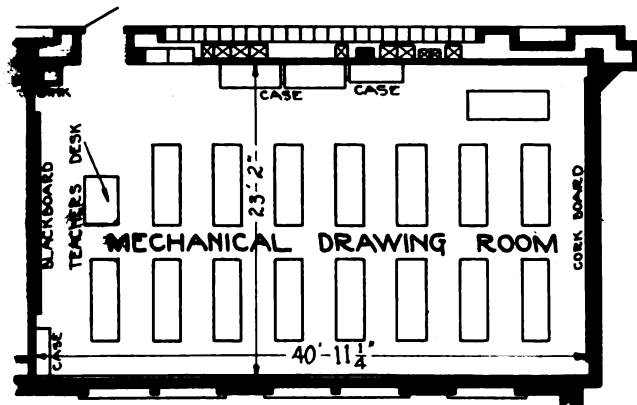
Auto Mechanics Service Book No. 66.—A 96-page manual, showing modern, up-to-date methods of handling automobile service jobs. Over 30 major jobs covered. Compiled with the assistance of automotive engineers and service managers of the leading car manufacturers.

Free on Request

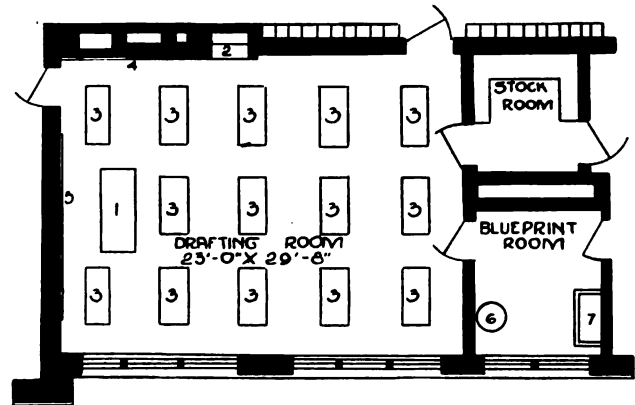
South Bend Lathe Works, 701 East Madison Street, South Bend, Indiana

Drafting-Room Layouts

For outlines of mechanical drafting courses see page 262
For equipment and supply lists, see pages 198-200

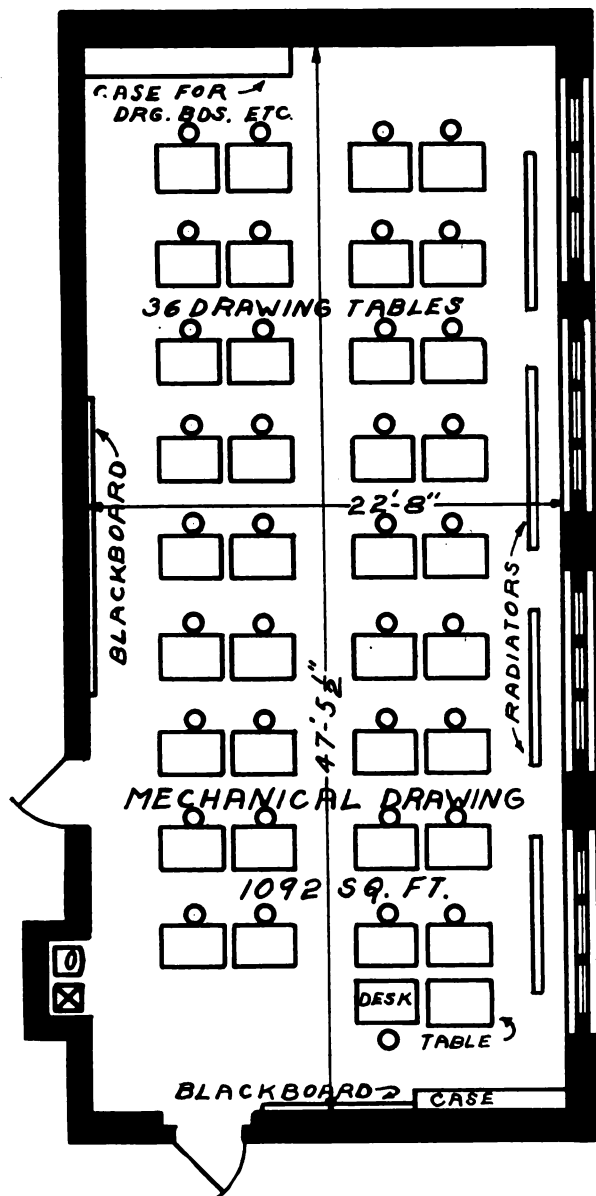


JUNIOR HIGH SCHOOL, CLEVELAND, OHIO

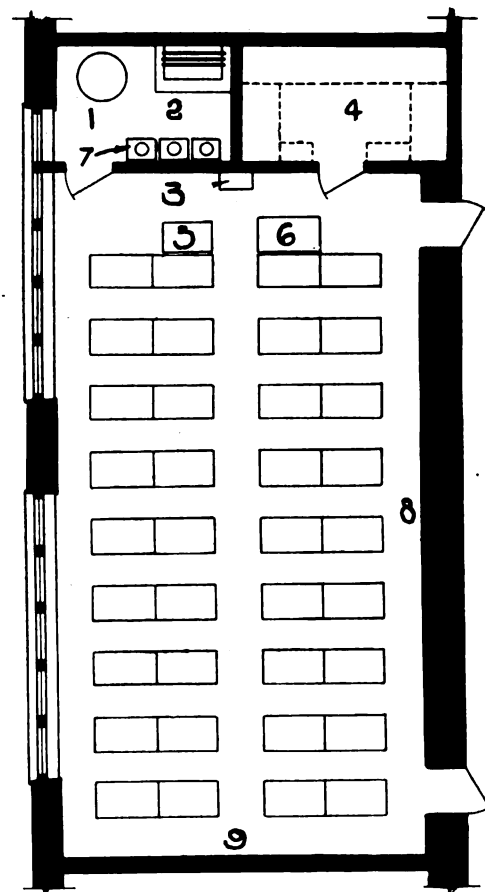


DRAFTING ROOM, NORMANDIN JUNIOR HIGH SCHOOL,
NEW BEDFORD, MASS.

- | | |
|--------------------------|-----------------------|
| 1. Teacher's Desk | 5. Blackboard |
| 2. Bookcase | 6. Blue-Print Machine |
| 3. Double Drafting Table | 7. Sink |
| 4. Bulletin Board | |

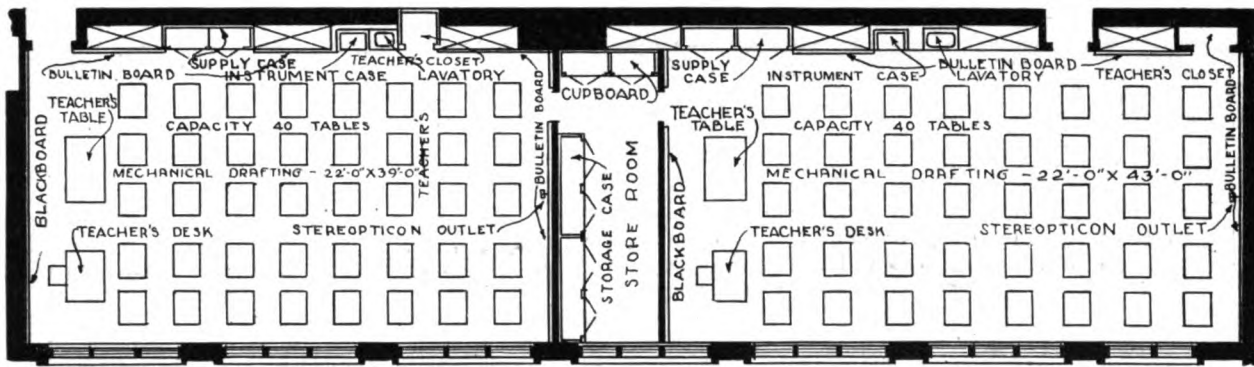


TYPICAL JUNIOR-HIGH-SCHOOL MECHANICAL-DRAWING
ROOM, MINNEAPOLIS, MINN.

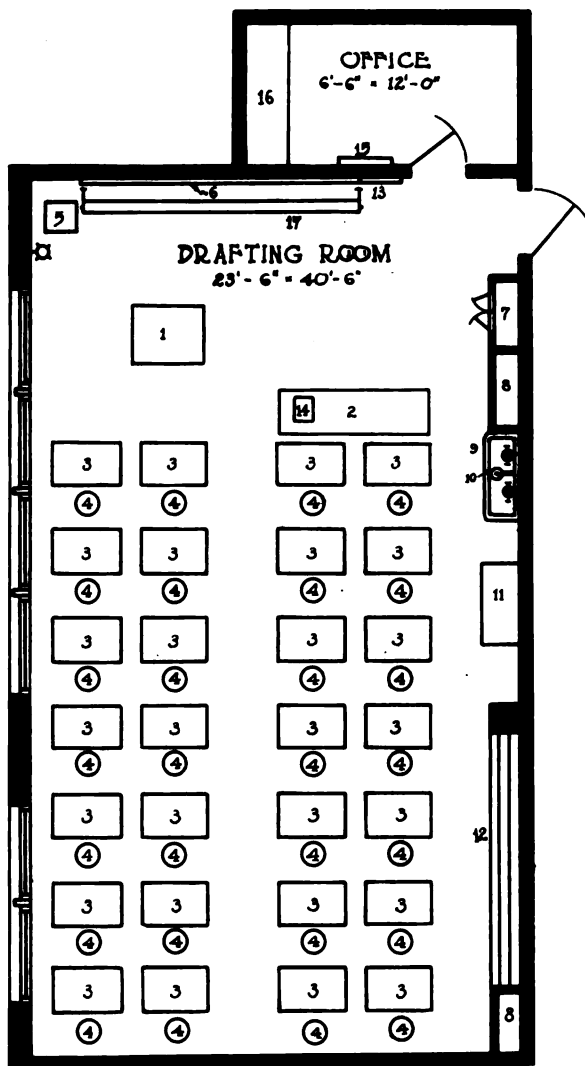


MECHANICAL-DRAWING ROOM, CLIFTON PARK JUNIOR
HIGH SCHOOL, BALTIMORE, MD.

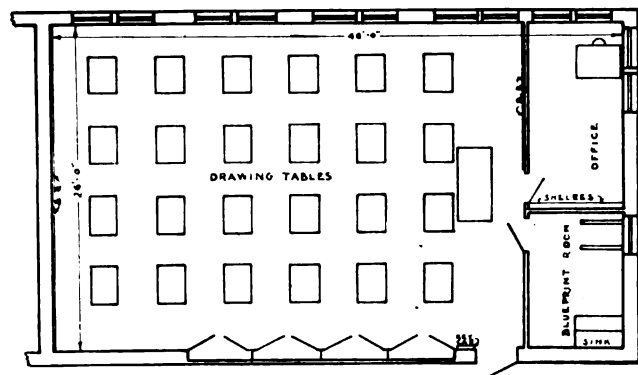
- | | |
|-----------------------|-------------------|
| 1. Blue-Print Machine | 6. Teacher's Desk |
| 2. Washer and Dryer | 7. Washbowls |
| 3. Instrument Cabinet | 8. Blackboard |
| 4. Cupboards | 9. Bulletin Board |
| 5. Paper Cabinet | |



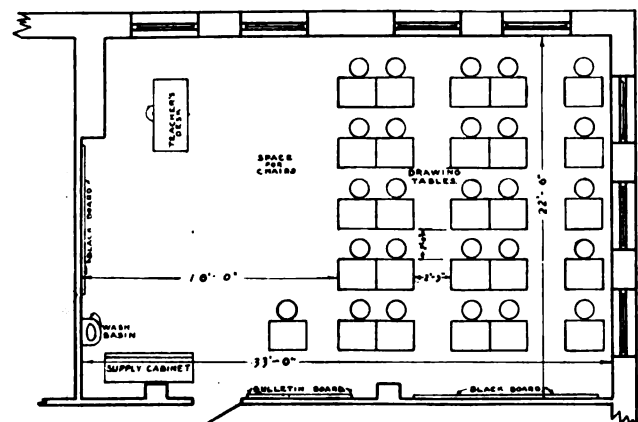
MECHANICAL-DRAWING ROOMS, ANDREW JACKSON INTERMEDIATE SCHOOL, DETROIT, MICH.



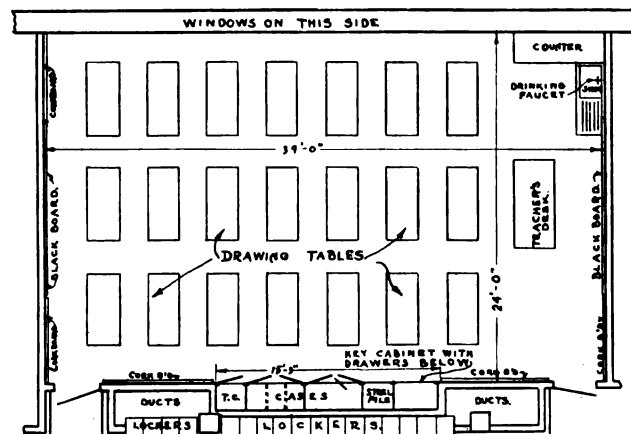
NORTH JUNIOR HIGH SCHOOL, EVERETT, WASH.



JUNIOR HIGH SCHOOL, WEST ALLIS, WIS.

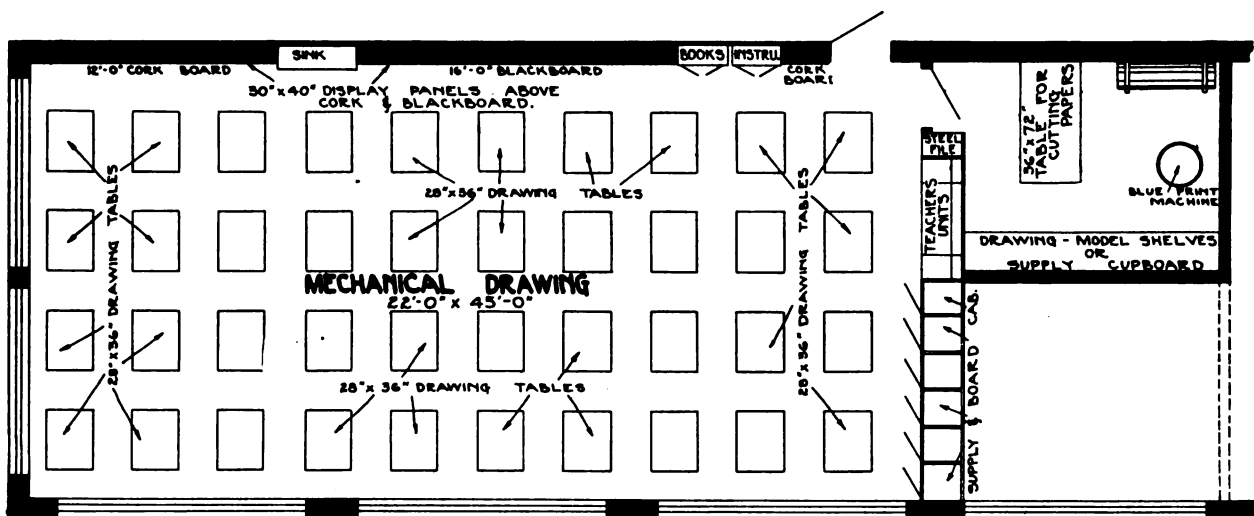


MECHANICAL-DRAWING ROOM, EAST JUNIOR HIGH SCHOOL, SIOUX CITY, IOWA

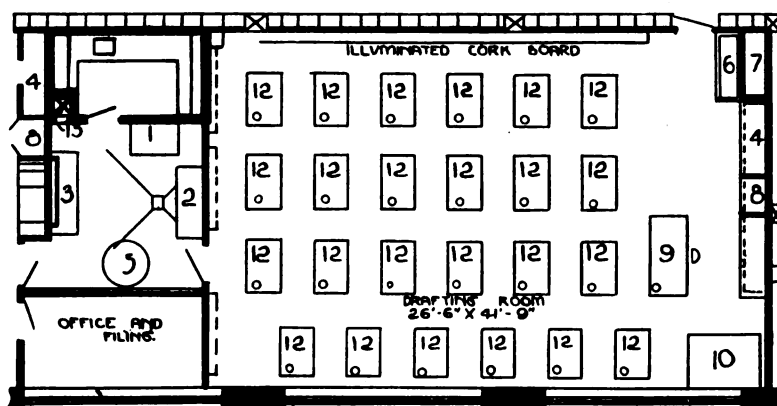


JUNIOR HIGH SCHOOL, CHICAGO, ILL.

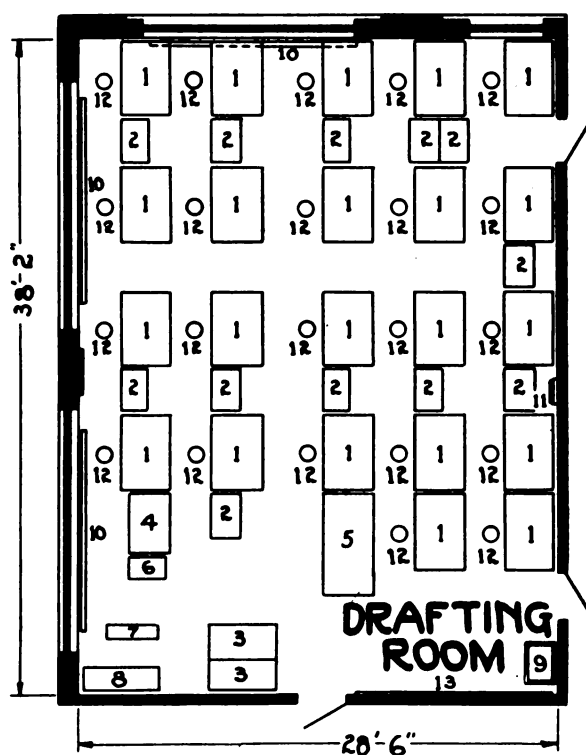
1. Teacher's desk
2. Table for blue-print paper
3. Drafting tables
4. Stools
5. Pease "Junior" blue-print machine
6. Blackboard
7. Case with glass doors for shop library, etc.
8. Air duct
9. Sink
10. Drinking fountain
11. Pease "Junior" blue-print washer
12. Drying rack for blue prints
13. Bulletin board
14. Paper cutter
15. Key cabinet
16. Case, for supplies
17. Large models of the rule and Architect scale



JUNIOR HIGH SCHOOL, HAMTRAMCK, MICH.

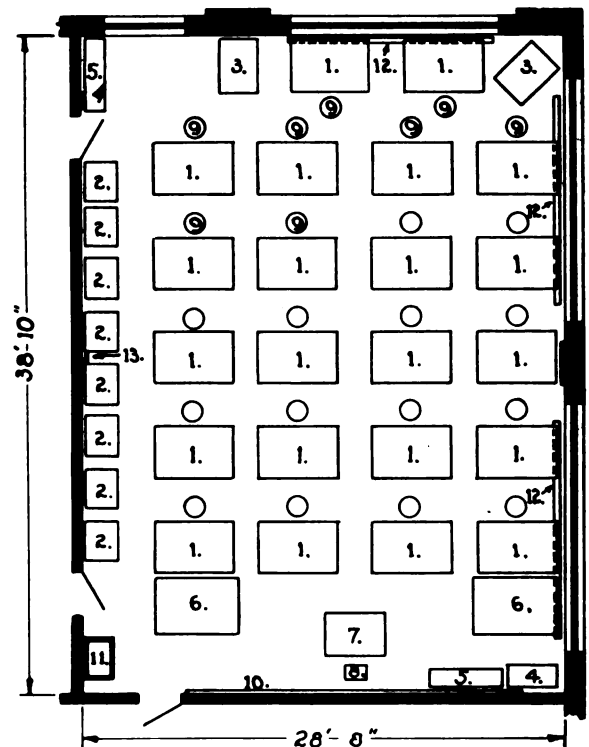


DRAFTING ROOM, PONTIAC HIGH SCHOOL, PONTIAC, MICH.



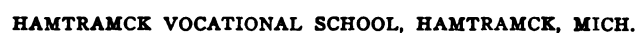
JOHN C. FREMONT HIGH SCHOOL, LOS ANGELES, CALIF.

- | | |
|---------------------------|-----------------------|
| 1. Drawing Tables | 8. Supply Cabinet |
| 2. Steel Lockers | 9. Sink |
| 3. Drawing-Board Cabinets | 10. Radiators |
| 4. Instructor's Desk | 11. Clock |
| 5. Model Table | 12. 22 Drawing Stools |
| 6. Letter Filing Cabinet | 13. Blackboard |
| 7. Bookcase | |



JOHN C. FREMONT HIGH SCHOOL, LOS ANGELES, CALIF.

- | | |
|---------------------------|-----------------------|
| 1. Drawing Tables | 8. Instructor's Chair |
| 2. Lockers | 9. 22 Stools |
| 3. Drawing-Board Cabinets | 10. Blackboard |
| 4. Supply Cabinet | 11. Sink |
| 5. Bookcases | 12. Radiators |
| 6. Model Tables | 13. Clock |
| 7. Instructor's Desk | |



Drafting Equipment

30 Students Per Class

Name and Description	Elementary School	Junior High School	Senior High School	Technical High and Full-Time Vocational Schools	Part-Time Vocational School
Adjustable-Curve Ruler	1	1	1	1	1
Beam Compass	0	0	1	2	1
Bench Brushes	15	15	15	15	15
Blackboards					
Compass, 15", with locking device	1	1	1	1	1
Drawing set: T square straightedge, triangle, and protractor	1	1	1	1	1
Permanent or portable.....		1 or more as required			
Blue-Print					
Frame or machine.....	0	1	1	1	1
Washing trays or washer...	0	1	1	1	1
Paper tube, air-tight.....	0	1	1	1	1
Drying rack	0	1	1	1	1
Bookcase, for reference library	0	1	1	1	1
Cabinet					
For filing drawings.....		1 or more as required			
For storing drawing boards.		1 or more as required			
For storing drawing instruments	0	1	1	1	1
For storing models.....	1	1	1	1	1
Calipers					
6" inside and outside, each..	0	1	2	2	2
8" inside and outside, each..	0	1	2	2	2
Desk					
Teacher's	0	1	1	1	1
Chair to match.....	0	1	1	1	1
Dividers, proportional.....	0	0	1	1	1
Drafting machine and accessories	0	0	0	1	0
Draftsman's Steel Protractor..	0	0	0	1	1
Drawing Boards, large.....	0	0	1	4	2
Drawing-Board Supports, to be set on or attached to wood-worker's bench	30	0	0	0	0
Drawing Tables and Stools					
For students.....	0	30	30	30	30
For teacher.....	1	1	1	1	1
Ink-Bottle Holder.....	0	30	30	30	30
Irregular Curves, Nos. 21 and 24, wood, rubber, or transparent, each.....	0	1	2	2	2
Lettering Angles	0	0	0	2	0
Level or Transit, builders', for architectural students	0	0	0	1	0
Leveling Rod, for use with the transit	0	0	0	1	0
Machinists' Combination Set, 12"	0	0	1	1	1
Marking Pins, for use with measuring tape, for architectural students.....	0	0	0	12	0
Micrometer, 1", for mechanical-drafting students	0	0	0	2	0
Oilstone, 3" case.....	0	1	1	1	1
Parallel Rules.....	0	0	0	2	0
Planimeters.	0	0	0	2	0
Plumb Bob	0	0	2	2	2

See classified directory for sources of supply

Name and Description	Elementary School	Junior High School	Senior High School	Technical High and Full-Time Vocational Schools	Part-Time Vocational School
Shears , for trimming blue prints and drawings.....	1	1	2	2	2
Speed Counter , for mechanical-drafting students	0	0	0	2	2
Steel Scales , 12".....	0	1	2	2	2
Stop Watch , for mechanical-drafting students.....	0	0	0	1	0
Table For cutting and trimming drawings and blue prints.	1	1	1	1	1
For disassembling and reassembling machine parts and models	0	1	1	1	1
Tapeline 100', steel, for architectural students	0	0	0	1	0
50', steel or metallic.....	0	1	1	1	1
Tool Box , containing 1 machinist's hammer, one 6" adjustable wrench, one 6" screw driver, one pr. 6" combination pliers	0	1	1	1	1
Triangles 30-60-deg. 14" transparent...	0	0	1	1	1
45-deg. 10" transparent....	0	0	1	1	1
Triangular Scales , civil engineers' type, 12".....	0	0	1	2	1
T Square Adjustable head, for large drawing board	0	0	1	1	1
Or straightedge with parallel rule attachment for large drawing boards	0	0	1	4	2
Wall Charts , lettering, decimal equivalents, etc., each.....	0	1	1	1	1
Yardstick	2	2	4	4	4

Drafting

Small Equipment

To be provided by, or for, each student.

Number specified shows what is required for each student.

Name and Description	Elementary School	Junior High School	Senior High School	Technical High and Full-Time Vocational Schools	Part-Time Vocational School
Drawing Board , size to be specified by the instructor..	1	1	1	1	1
Drawing Instruments , as specified by the instructor, sets..	0	1	1	1	1
Erasing Shield	1	1	1	1	1
Irregular Curve , Nos. 8 and 13, transparent, each	0	0	1	1	1
Pencil Compass	1	0	0	0	0
Penholder , for lettering pens..	0	1	1	1	1
Pens , assorted, for lettering...	0	6	6	6	6
Protractor , not over 5".....	0	1	1	0	0
Scale , 12" architect's, triangular	0	1	1	1	1

Use post-card service for special information

Name and Description	Elementary School	Junior High School	Senior High School	Technical High and Full-Time Vocational Schools	Part-Time Vocational School
Scale Guard.....	0	1	1	1	1
Slide Rule, 10", as specified by the instructor.....	0	0	0	1	0
T Square, to fit drawing board	1	1	1	1	1
Triangles					
30—60-deg., 8" transparent..	1	1	1	1	1
45-deg., 6" transparent.....	1	1	1	1	1

Drafting Supplies

30 Students Per Class

Name and Description	Elementary School	Junior High School	Senior High School	Technical High and Full-Time Vocational Schools	Part-Time Vocational School
Bichromate of Potash, crystals, lb.	0	5	5	5	5
Blue-Print					
Paper, 36" wide, yd.....	0	50	50	50	50
Writing fluid, bottles.....	0	1	1	1	1
Paper					
Cross-section, 8½"x11", reams	1	1	1	1	1
Detail, 24"x36", reams.....	1	1	1	2	1
Drawing, 24"x36", reams....	1	1	1	2	1
Isometric, 7"x10", sheets....	0	0	200	200	200
Tracing, 36", yd.....	0	20	20	30	20
Powder, for tracing cloth, cans	0	2	2	2	2
Tracing Cloth, 36", yd.....	0	24	24	36	24
Van Dyke					
Fixing salts, 4-oz. cans.....	0	0	1	1	1
Paper, 36", yd.....	0	0	10	10	10
Writing fluid, 2-oz. bottles..	0	0	1	1	1

Drafting Additional Supplies

To be provided by, or for, each student.

Amount specified shows what is required for each student.

Name and Description	Elementary School	Junior High School	Senior High School	Technical High and Full-Time Vocational Schools	Part-Time Vocational School
Erasers					
Cleaning	1	1	1	1	1
Ink	0	1	1	1	1
Pencil	1	1	1	1	1
Ink					
Black, waterproof, ¾-oz., bottles	0	1	1	1	1
Colored, if required, ¾-oz., bottles of each color.....	0	1	1	1	1
Pencils, drawing, 3H, 4H, and 6H, each.....	1	2	2	2	2
Pencil-Pointer Pad.....	0	1	1	1	1
Thumb Tacks	25	25	25	25	25

See classified directory for sources of supply

E. H. Sheldon & Company

Muskegon, Michigan

ESTABLISHED 1898

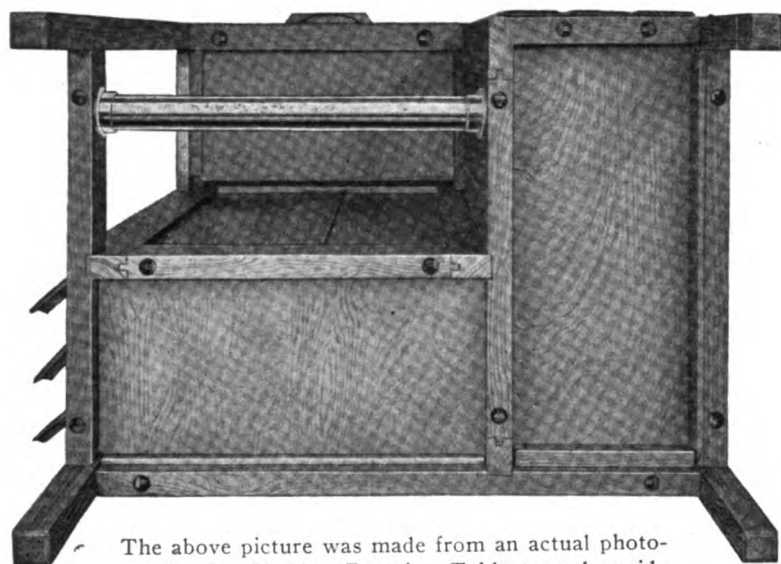
Manufacturers of

Art and Mechanical Drawing Tables

50,000 Now in Use

Drawing Tables are ordinarily constructed of light material under the impression that they are not subjected to as severe usage as work benches or laboratory tables. Experience has shown, however, that unless unusual care is taken in construction and unless heavy, strong material is used throughout, drawing tables are soon retired to the repair

shop. This is because drawing tables are higher than work benches or laboratory tables, pupils lean against them creating a severe transverse and longitudinal strain, doors and drawers are jerked open and slammed shut, changes in temperature affect them, and ordinary construction will not stand the strain.



The above picture was made from an actual photograph of a Sheldon Drawing Table turned upside down. The picture shows the size of the stock used and the Sheldon method of tying each joint with bolts in addition to the regular mortise and tenoning.

Present Sheldon Drawing Table Construction

As the result of the above experience our present drawing table construction was developed. To show this new construction clearly we turned a table upside down and photographed it for you. One and three-eighths inch rails and stiles are used throughout, and all joints are mortised and tenoned, glued under high pressure and cross-tie-bolted as shown. This construction which increases the weight of our drawing tables twenty per cent entirely eliminates from them the weaknesses found in tables incorporating light construction. They will give years and years of service long after tables of ordinary construction have ceased to function. The initial cost may be a little more; the final cost will be a great deal less.

For Satisfaction Specify Sheldon Drawing Table Construction

Our reasons for using heavy bolt re-enforced construction in our Drawing Tables will be of special interest to you when we admit that we built our drawing tables of light material until experience proved that we were wrong!

Our Experience with Light Construction

Up until 1917 we used the ordinary $\frac{3}{4}$ -inch construction common to commercial drawing room furniture. At that time complaints began to come in to the effect, that, after six or seven years of service, the tables no longer gave satisfaction. A careful investigation was made and we became convinced that the light construction was not satisfactory for school use. Drawing tables are higher than work benches or laboratory tables, pupils lean against them creating a tremendous transverse and longitudinal strain, doors and drawers are jerked open and slammed shut, changes in temperature affect them, and ordinary construction will not stand the strain.



24 Designs to Choose From

Send today for literature illustrating and describing two dozen different designs which we build for the drawing department. We build tables to accommodate from one to eight classes, with private lockers for each student.

E. H. Sheldon & Company, Muskegon, Michigan

Eugene Dietzgen Co.

Chicago

2425 Sheffield Ave.

New York

218 E. 23rd St.

San Francisco

523 Market St.

New Orleans

318 Camp St.

Pittsburgh

805 Liberty Ave.

Milwaukee

378 Broadway

Philadelphia

1521 Sansom St.

Los Angeles

854 So. Hill St.

Washington, D. C.

407 Tenth St. S. W.

Manufacturers of

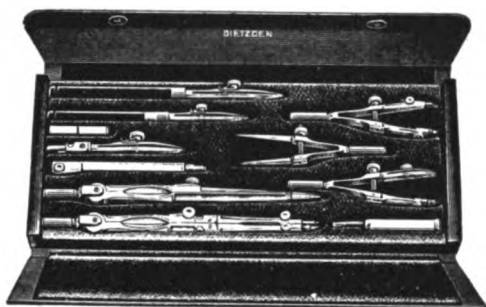
Drafting Instruments and Supplies

We have ten grades of drawing instruments—a grade for every purpose and purse. The top grades of our drawing instruments are the finest instruments obtainable, and are universally standard among the professional trade. Our school grades, the four most popular of which are listed below, are standard in practically every school in the country and are universally the choice among instructors



Federal Drawing Instruments

An excellent quality, square American type, instrument. Substantially made of dense rolled nickel silver and steel, carefully finished. Compasses and Dividers equipped with differential straightening device. Compasses and Bow Instruments fitted with screw-thread needle points. Ruling Pens and Pen part of Compasses have slide-catch cleaning devices. Furnished in Pocket Case lined with Silk Velvet.



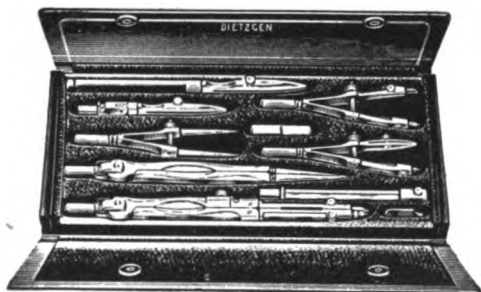
No. 1047

No. 1047 contains 5 and 5½-in. spring blade Ruling Pens; 3¼-in. side-screw Bow Dividers, Bow Pencil, Bow Pen; 6-in. hair spring adjustable Dividers; 6-in. Compasses with Pencil part, Pen part and Lengthening Bar; Lead Box and Key; Box with extra needle points.

No. 1046. Same as No. 1047, but without the 5-in. Ruling Pen.

Scholar Drawing Instruments

A square American type instrument, made of rolled nickel silver and steel. Compass and Dividers equipped with straightening device. Compasses and Bow Pencil and Pen have reversible and replaceable needle points. Furnished in Pocket Case lined with velvet.



No. 1076D

No. 1076D contains 5½-in. spring blade Ruling Pen; 3¼-in. side-screw Bow Dividers, Bow Pencil, Bow Pen; 6-in. plain Dividers; 6-in. Compasses with Pencil part, Pen part, and Lengthening Bar; Key; Lead Box with extra leads.

No. 1077D. Same as No. 1076D, with addition of a 5-in. Ruling Pen.

It might be well to mention that all Dietzgen Instruments are made exclusively in Dietzgen Factories and are standardized. The parts in each grade are interchangeable. These parts are listed in our catalog which affords complete replacement and repair part service at your finger tips.

We have arranged complete repair parts of the popular grades into repair kits, as No. 993. These kits will service about

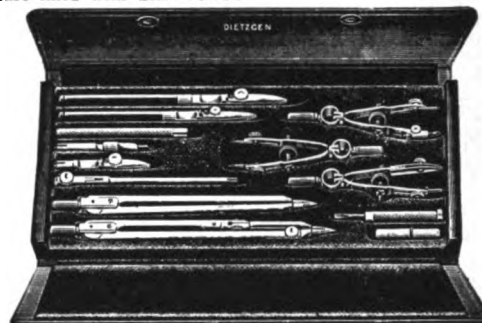


No. 993

who pride themselves on equipping their students with the best sets obtainable for the money expended. Each of our grades of instruments is put up in different size sets. Below you will find what we term complete six and seven piece sets. You will note that they are of two styles—the square or trigonal type and the flat, round type. The type of instrument is always a matter of individual choice.

Universal Drawing Instruments

A good quality, flat round type instrument. Made of rolled nickel silver and steel, nicely finished. Compasses and Dividers equipped with straightening device. Compasses and Bow Instruments fitted with adjustable and reversible needle points; Ruling Pens and Pen part of Compasses equipped with slide-catch Cleaning device. Furnished in Pocket case lined with Silk Velvet.



No. 1057C

No. 1057C contains 5 and 5½-in. spring blade Ruling Pens; 3¼-in. Center screw Bow Dividers, Bow Pencil, Bow Pen; 6-in. hair spring adjustable Divider; 6-in. Compasses with Pencil part, Pen part, Divider part, Lengthening Bar, and extra metal handle for use with Pencil and Pen parts of Compasses; Lead Box with Key; Box with extra needle points.

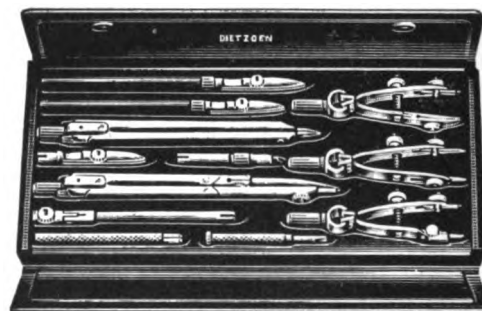
No. 1057. Same as No. 1057C, but Bow Instruments have side wheel.

No. 1056C. Same as No. 1057C, but without 5-in. Ruling Pen.

No. 1056. Same as No. 1056C, but Bow Instruments have side wheel.

Prep Drawing Instruments

A flat round type instrument made of nickel silver and steel. Compass and Dividers equipped with straightening device. Compasses and Dividers and Bow Instruments have reversible and replaceable needle points. Furnished in Pocket Case lined with Velvet.



No. 1087S

No. 1087S contains 5 and 5½-in. spring blade Ruling Pens; 3¼-in. side-screw Bow Dividers, Bow Pencil, Bow Pen; 6-in. plain Divider; 6-in. Compasses with Divider part, Pencil part, Pen part, Lengthening Bar, and extra metal handle for use with Pencil and Pen parts; Lead box with key.

No. 1086S. Same as No. 1087S, but without the 5-in. Ruling Pen.

50 instruments of one grade. Repairs can be made immediately, thus eliminating the inconvenience of having instruments lying around for repair, and holding work up.

When you specify or order drawing instruments, keep this repair and replacement service in mind. It is mighty important to the school and the student. See our catalog for complete information. Let us quote on your requirements; we have special discounts for schools and institutions.

Chicago

Eugene Dietzgen Co.

New York

Eugene Dietzgen Co.—Continued

Dietzgen Drawing Materials

For forty years the house of Dietzgen has worked with the conviction that the success of a draftsman in a measure depends upon the equipment used. Proper design, balance, workmanship, durability—in other words, the equipment of the proper quality begets and inspires the best work. In justification

of this conviction, our drawing materials have become the standard equipment of the country's leading schools. We exercise a careful diligence in maintaining our reputation for quality, service and fair prices. Our special school prices appeal to all instructors.

Triangular Scales



No. 1626

U. S. Standard, machine divided, selected seasoned material, deep cut lines, fine finish.

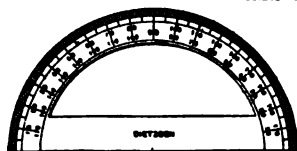
No. 1626. Architects, mechanical engineers triangular boxwood scale; 12 in. open divided: $\frac{1}{8}$, $\frac{1}{4}$, $\frac{3}{8}$, $\frac{1}{2}$, $\frac{5}{8}$, $\frac{3}{4}$, 1, $1\frac{1}{4}$, 3 in. to the foot, $\frac{1}{16}$ in. Each.

No. 31626. Like No. 1626, but of hardwood.....Doz.

No. 1636. Civil Engineers triangular boxwood scale; 12 in. divided: 10, 20, 30, 40, 50, 60 parts to the in. Each.

No. 31636. Like No. 1636, but of hardwood.....Doz.

Brass Protractors



Semi-Circular Brass Protractors divided in degrees both ways.

No. 1935 $\frac{1}{2}$. 3 $\frac{1}{2}$ in., Each.

No. 1936. 4 $\frac{1}{4}$ in., Each.

Transparent Celluloid Curves

Accurately made, nicely finished.



Style 6 Style 8 Style 13 Style 15 Style 16

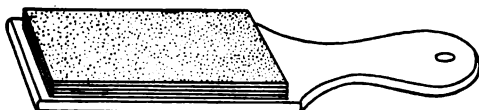
Dietzgen Drawing Ink



In the new handy bottle with screw cap stopper—easy to use—quill always reaches the bottom of bottle. The ink flows freely, dries quickly, contains no grit or acid, and is absolutely uniform. Universally used among artists and professional draftsmen, and in leading schools, colleges and universities.

No. 2681. Black and 10 fast brilliant colors. In $\frac{1}{4}$ Oz., 4 Oz., $\frac{1}{2}$ Pt., and Qt. Bottles.

Pencil Pointers



No. 3213. Pencil Pointer, 12 sheets, $1\frac{1}{4} \times 4$ in., Sand Paper, with handle.

No. 3220. Pencil Pointer, 12 sheets, $1\frac{1}{4} \times 4$ in., Emery Paper, with handle.

Mechanical Drawing Paper

Size 19x24, per quire or ream.

No. 9. White, slightly grained surface, strong, excellent erasing qualities, a perfect pencil paper, suitable for ink or color work.

No. 9A. Same as No. 9, but smooth surface.

No. 10. White, a good school drawing paper, slightly grained surface.

No. 11. Light cream, slightly grained surface, strong, stands erasing well, takes ink, pencil or color.

No. 11A. Light cream, high grade, slightly grained surface, strong, excellent erasing qualities. Takes pencil, ink, or color.

We have special discounts for schools and Institutions.

Transparent Celluloid Triangles



No. 2014



No. 2015

Made of seasoned material, retain their transparency and trueness, and will give years of satisfactory service for accurate work.

No. 2014. Thickness, .06, 30x60°, Plain, Size 4, 6, 8, 10, 12 inches.

No. 2015. Thickness, .06, 45°, Plain, Size 3, 6, 8, 10, 12 inches.

Stamped Steel Thumb Tacks



Made of best quality, nickel-plated hard steel, needle finish point, put 100 in a box or a dozen in a box.

No. 2440. $\frac{3}{8}$ in., Box of 100.

No. 2440B. $\frac{3}{8}$ in., Box of 1 Doz.

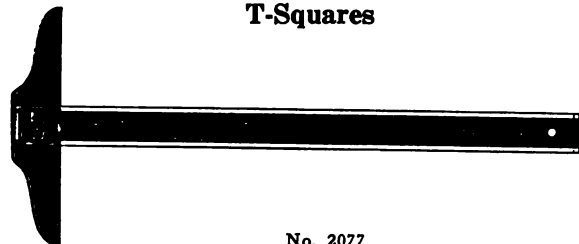
No. 2441. $\frac{1}{2}$ in., Box of 100.

No. 2441B. $\frac{1}{2}$ in., Box of 1 Doz.

No. 2442. $\frac{5}{8}$ in., Box of 100.

No. 2442B. $\frac{5}{8}$ in., Box of 1 Doz.

T-Squares



No. 2077

The trueness and durability of our T-Squares is obtained by selecting thoroughly seasoned material and perfect workmanship.

No. 2060. Maple Blade and Head, Fixed Head, Sizes 18, 21, 24, 30, 36 in.Each.

No. 2077. Transparent Celluloid lined Blade, Fixed Head, Sizes 18, 24, 30, 36, 42 in.Each.

Drawing Boards



No. 4406. Made of strips of selected white wood. Two drawing surfaces and end cleats. Sizes 16x22, 18x24, 20x24 $\frac{1}{2}$, 20x26, 23x31 in.

No. 4410. Made of strips of selected, well-seasoned white pine wood joined together by tongue and groove. Two drawing surfaces and end cleats. Sizes 16x22, 18x24, 20x24 $\frac{1}{2}$, 20x26, 23x31 in.

To Save Your Needed Time



This booklet, the "Use and Care of Drawing Instruments," covers thoroughly the details of this subject. Available to Instructors gratis for distribution at the beginning of the semester. Give us the number of students anticipated, and the beginning date of next semester, and we will send you that quantity in proper time.

Write us your requirements and let us send you an estimate of cost.

Chicago

Eugene Dietzgen Company

New York

The C. F. Pease Company

801 N. Franklin St., Chicago, Ill.

TELEPHONE Superior 5860

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Manufacturers of

Blue-Printing Machinery, Blue-Printing Accessories, Blue-Print Paper, Drawing Room Furniture, Drawing Instruments, Drawing Room and Engineering Supplies

Pease "Junior" School Model Blue-Printing Equipment

Teach students to make their own blue-prints the modern way on the Pease "Junior" Blue-Printing Machine—just the right type of equipment for the school drawing room. Low priced, simple and economical to operate, and will produce blue-prints in any size up to 24x36" on a moment's notice regardless of weather conditions. The machine alone requires a floor space of only 25x26" and can be plugged into the lighting circuit. No special electrical connections are required; can be used with either 220 volts AC or DC or 110 volts AC or DC.



The Pease "Junior" Blue-Printing Machine and Sheet Washer.

Ask for Catalog MV-01

The Pease "Junior" Sheet Washer

The Pease "Junior" Sheet Washer is provided with both a spray pipe and drain pipe, completely dispensing with open bath trays, dripping prints, and wet floors. Prints can be thoroughly washed, hung on a rack to dry, and be ready for use very shortly afterward, with the least trouble and inconvenience.

Ask for Catalog SW-01.

Pease Blue-Print and Negative Papers

Pease Blue-Print Paper is the nearest non-fading blue-print paper in existence and is specially coated on machines of our own design with a scientifically prepared formula under an improved process. Every shipment of Pease Paper is guaranteed to be exactly the rag content stock specified, in rolls of one piece, each of full measure. Both Pease Papers and Cloths have a wide range of exposure, are coated in four printing speeds, and have lasting qualities which make them excellent for permanent prints.

Ask for Pamphlet BP-01.

Pease Drawing and Tracing Papers and Cloths

Pease Drawing Papers and Cloths are manufactured in specially equipped mills using only high-grade raw materials, and uniformity of both surface and thickness of sheets is a certainty. Sample books or working samples will be furnished immediately to drawing instructors, upon request.

Ask for Sample Book No. 01

Pease Imported School Drawing Instruments

Pease School Drawing Instruments are of simple mechanical construction, easy to manipulate, and have a smooth nickel finish, providing ease of operation and freedom of movement. They contain exactly the proper balance and degree of precision essential to the best efforts of the student. Complete sets are manufactured in two styles—semi-flat and square, while various assortments or separate pieces can also be obtained.

Ask for Catalog DI-01.



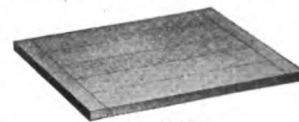
Set No. 850.



Pease School Drawing Room Furniture

DRAWING BOARDS—Economical, yet carefully constructed to stand hard school usage. Board illustrated furnished in either Pine or Basswood

with two drawing surfaces. Has tongued and grooved construction with end cleats, $\frac{3}{4}$ " thick and furnished in sizes from 12x17" up to 31x42".



No. 2200.

DRAWING TABLES—Here is one of the popular Pease School Drawing Tables (No. 2237) designed to accommodate

six students, with individual tool drawers and an equal number of drawing board compartments, each with a separate lock and key. Drawing Board top is made of Basswood and is easily adjustable as to slant. Dimensions of board top is 28 $\frac{1}{2}$ x38"; base is 25" deep, 35 $\frac{5}{8}$ " wide and 40" high to the working surface. Table has iron pipe foot rail; also metal shoes on the legs to withstand hard usage and is made of oak with golden oak rub finish.



No. 2237.

Another popular Pease Drawing Table is the "Union" No. 2245. Made of hardwood and has Pinewood top. Top is adjustable both as to height and slant. Construction is very firm and rigid and practically eliminates all vibration. Can be had equipped either with or without special tool compartment with two drawers.



No. 2245.



No. 2249A.

PEERLESS DRAWING STANDS—A moderately priced substantial Artists Stand of tubular construction finished in nickel plate and black enamel. Cork inserts in feet of the table make it solid and firm on the floor. Furnished complete with board and drawing tray and with Oak or Pine drawing board top with swivel head for tilting and revolving to any position.

PEASE SET-EZY STOOL—Especially adapted for students' use. Provides comfort and relaxation, promoting better work. Has a four point suspension spring seat and a securely riveted steel angle frame perfectly leveled to set solidly. Rubber feet or smooth rolling hard casters can be furnished if desired. Furnished with or without back and foot rest and attractively finished in olive green baked enamel.



No. 2297.

Ask for Catalog F-01.

Scales, Angles, and T-Squares

The Pease line includes a complete assortment of plain, boxwood and celluloid scales, angles, T-squares, slide rules, curves, straight edges, etc., in all styles and sizes.

Pease Special School Catalog

Pease Special School Catalog includes full listings of blue-printing machinery specially designed for school use, school drawing room furniture, drawing instruments, etc. Every instructor of mechanical drawing or manual training should have a copy of this catalog handy for ready reference.

Ask for Catalog SC-01.

The C. F. Pease Company, 801 N. Franklin St., Chicago, Ill.

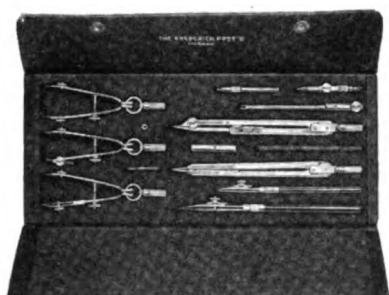
The Frederick Post Company

P. O. Box 803—Chicago, Illinois

Manufacturers of

Everything for the School Drafting Room

Students' Drawing Instruments



No. 91035

You will find the set of drawing instruments that meets your approval and sells at a very reasonable price in our special line of school instruments—built to withstand hard usage, yet, smooth working and accurate, they help to bring out the best work in each student.

This set No. 91035 is so remarkably popular with schools because of its sturdy build, fine finish, and very moderate price. Complete information and prices on this and other school sets will gladly be furnished.



No. 2422

Post's Standard American Drawing Ink

Post's Standard American Drawing Ink is known the world over for its smooth flowing, extra waterproof, dense and opaque qualities, sold in $\frac{3}{4}$ oz., $\frac{1}{2}$ pint, pint and quart bottles at popular prices.

Black and twelve colors.

Drawing Papers

Drawing teachers have played a large part in the manufacture of Post's Drawing Papers as their requirements have practically formed our specifications for its manufacture. Classic a white paper with a slightly grained surface takes ink, pencil or crayon exceptionally. Postex (Buff) is unsurpassed for shop work—write for full information.

Students' Triangular Scales

Post's Triangular Boxwood Scales are fast becoming the standard scale in schools and colleges because of their consistent high degree of accuracy; machine divided $\frac{1}{16}$, $\frac{1}{8}$, $\frac{1}{4}$, $\frac{3}{8}$, $\frac{1}{2}$, $\frac{3}{4}$, 1, $1\frac{1}{4}$; 3 in. to foot.



No. 91301

Drawing Boards

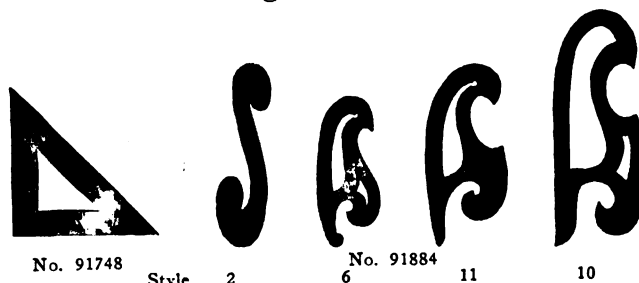


No. 92253

Post's strong, carefully constructed school drawing boards are made in sizes from 12x17 up to 23x31 with two drawing surfaces, veneered or plain, and in $\frac{3}{4}$ ", $\frac{1}{2}$ " and $\frac{3}{8}$ " thickness.

No. 92253, basswood, $\frac{3}{4}$ in. thick, has two drawing surfaces and end cleats. A wide selection of our school drawing boards are carried in stock—write for prices.

Triangles and Curves



No. 91748

Style 2

No. 91884

6

11

10

Our school triangles are made of Beechwood and celluloid in 30°-60° and 45° angles and in 6, 8, 10 and 12 inch sizes. We also carry a wide selection of irregular curves in stock.

Post's Three-In-One Instruments



No. 91117

Post's Three-In-One Instruments are now being used by many schools because they offer a complete set—Divider, Pen and Pencil Compass at a very low price and give entirely satisfactory service.

This little combination pocket instrument is furnished in velvet lined leatherette case or in cardboard cartons. Write for prices.

A Full Line of School Drafting Room Supplies

Drawing Tables, Slide Rules, Tee Squares, Protractors, Pencils, Thumb Tacks and everything for the drafting room is carried in stock, making possible our quick delivery. May we send you prices and our school catalog—it's a real help to buyers of school supplies.

The Frederick Post Company, P. O. Box 803, Chicago, Ill.

Technical Supply Company

Scranton, Pa.

Manufacturers of

"Tesco" School Furniture

This page describes a few of the many items manufactured by the Technical Supply Company for school use. We are in a position to supply your needs for Cafeteria, Primary, Sewing, Biology, Kindergarten, Physics, and Do-



mestic Science Tables. A catalog describing our complete line will be furnished upon request. We also manufacture a full line of drawing materials, Boards, Tee Squares, Triangles, Curves, Instruments, etc.



2269B

2269B. Our most popular Art Table, because of the neatness of the drawer locker system, having six individual drawers, 12 $\frac{1}{2}$ x17 $\frac{1}{2}$ x4 inches inside measurements. Each side of drawer babbled one inch so that you can set in a 12x17 inch board leaving a space underneath to take care of water colors, brushes, erasers, pencils, etc. This avoids confusion in the class room, letting the class get to their studies in a minimum amount of time. Length 37 inches, width 22 inches, height 30 inches.



2269A

2269A. A very economical table for use where individual storage is not required. This table is made of birch with natural finish top, American walnut base. Table is 34x21x30 inches high. With one drawer 10 inches wide, 17 inches deep, and 2 $\frac{1}{2}$ inches high. Adjustable portion of the top is 20x21 inches.

Shipping weight, 85 lbs.



2269E

2269E. Where this type table is used, students can go direct to their place and find materials properly cared for and ready for use, avoiding confusion and loss of time. Table has six drawers with solid brass locks, master keyed, no duplicates, protecting students' material and equipment from interference.

Top 40x21 inches. Height 30 inches. Six drawers 5x17x3 $\frac{1}{2}$ inches. One cupboard 11x17x20 inches.



2269G

2269G. Combination Pupil's Desk and Art Table for the grades. The table recommended for the smaller schools or in the larger system where drawing and art is taught in the grade, and the room is used for other classes such as History, English, a study room or other recitation subjects. The top of this table is made in two parts: one part adjustable to approximately 60° with a solid portion for holding brushes, water colors, instruments, etc., or entire top can be used flat. Underneath top is a compartment for holding books or papers, also a compartment 4x4 inches for water colors, brushes, etc.

Top, 18x27 inches overall. Adjustable portion 18x20 inches, solid portion, 18x7 inches. Height 30 inches. Shipping weight, 60 lbs.



7004A

7004A. An ideal Bookkeeping Desk with six drawers 10 $\frac{1}{2}$ x16x3 $\frac{1}{2}$ inches, and arm rest 18x10 $\frac{1}{2}$ inches. Accommodating six pupils, giving each a private locker. Table is 36x22x31 inches high. Shipping weight, 180 lbs.

7006A. Typewriter Desk. Same features and dimensions as our No. 7004A except an adjusting top of three different heights, accommodating pupils of different sizes.



7006A

2271A. A table for use where the locker system is not required. Table 28x36 inches x 40 inches high, with one general drawer 20x27 inches x 4 inches. This table can be furnished in either birch or oak.

Shipping weight, 125 lbs.

2271B. This table has one general drawer for the accommodation of papers, etc. At the right side of table are three lockers for the storage of Boards, Tee Squares, etc. In the lockers above the board is a shelf for the storage of instruments, angles, and scales. Height, 40 inches. Top 28x36 inches. Lockers, 20x26x3 inches. Drawer, 23x21x4 inches.

2271E. One of our most popular school tables. A design used where floor space has to be considered, and will accommodate six periods, each student having a private drawer with individual lock to take care of his drawing instruments and materials, and a general cabinet holding six drawing boards 20x26 inches.

Table top, 28x36 inches. Drawers 9x20x4 inches. Board cabinet 9x20x26 inches. Height 40 inches.

2271F. Table has one general drawer with a cupboard to hold six drawing boards 20x26 inches. It is designed to meet the needs of schools who furnish the equipment to the students, making it necessary to only supply one set of equipment to cover all classes. Top, 28x36 inches. Height, 40 inches. 1 Drawer 9x20x4 inches. Board cabinet 9x20x26 inches.



2271A



2271B



2271E



2271F

Technical Supply Company, Scranton, Pa.

United States Blue Print Paper Co.

(U. S. Blue Co.)

General Offices: 201-207 South Wabash Avenue

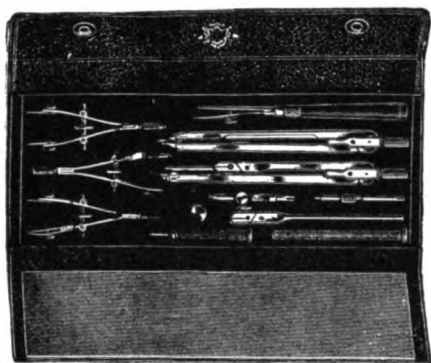
Factory: 553 West Monroe Street

Chicago, Illinois

Manufacturers and Dealers and Importers of

Drawing Instruments, Materials and Blue Print Papers

Richter instruments are the original of the most widely used type of drawing instruments. Distinguished by both design and high quality from the very beginning, the standards then set are still unchanged, making them the finest of drawing instruments in America. Only the very best of rolled German Silver and steels are used, making them extremely long lived when subjected to the rigors and abuses of school work.



Richter compasses and dividers, assist in high class work; have **absolutely true and steady joints** that can **never become loose** or work unevenly. Richter Spring Bow Instruments and Ruling Pens are of best quality steel and highest finish to prevent rust. All steel points are removable. The Richter instruments come in a wide variety of sets, the set illustrated, No. 835M, being one of the most popular for schools.

School Drawing Instruments

In addition to the Richter instruments, we also have available for school use other selections of instruments. All of the better class of very high quality, such lines known as the "Crescent," and the "Star." Details concerning these instruments sent upon request.

Set No. 1057

The set illustrated is of the "Star" brand which serves ideally as a durable low priced instrument. The case is of Pocket Book style and particular attention has been



devoted to the Ruling Pens, a most important feature as our experience has taught us. The combinations of instruments are several and of a variety such as will suit any requirements.

Triangles and Curves



Triangles are made of thoroughly seasoned transparent celluloid, 30x60° or 45x45°, and can be supplied both in the professional grade and in the school grade. Celluloid curves, transparent, for school use in plain or combination.

Scales



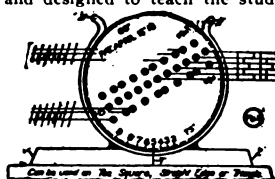
Above is illustrated the Triangular Boxwood scale No. 1731, U. S. Standard. It comes 12" long, divided in various scales to the foot. We also supply a high grade school quality made of hard maple, our No. 1731S, a most popular seller. Other scales are available, as shown in our catalog.

Drawing Paper

Our line of drawing papers is very complete. There is the highest quality white drawing paper for advanced mechanical drawing to the cheaper grade of paper for elementary class work. We handle the "Norman," "Veribest's," "Students and Cream," and other makes especially adapted for use in schools. Furnished in sheets or rolls.

Ames Lettering Instrument

A convenient little tool used extensively in a great number of Colleges and designed to teach the student proper lettering with the assistance of this simple and convenient device.



Our catalog contains a complete list and describes all materials necessary for the well-equipped drafting room and a copy of same with price list is yours for the asking.

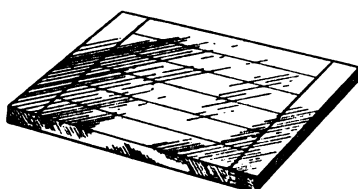
Drawing Tables



Our line of drawing tables include the "Simplex," "Monroe," "Ideal," "Champion," and also the well-known Hamilton drawing tables. The Hamilton No. 228 illustrated here has a top of selected white pine that can be furnished either solid or adjustable. The table measures 34 x 72 and has five drawers.

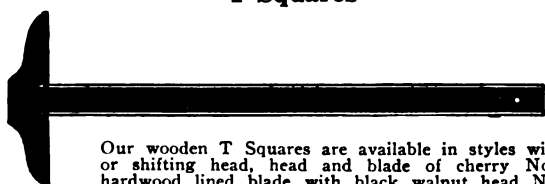
Drawing Boards

We carry a complete line of drawing boards in seasoned pine wood, bass wood, and 3-ply wood. The No. 2362 bass wood drawing board illustrated here is highly recommended for all schools and colleges. The wood being straight grained, the thumb tacks are easily removed and the points do not leave pin holes. Sizes from 12x17 to 31x42 inches.



No. 2362

T Squares



Our wooden T Squares are available in styles with fixed or shifting head, head and blade of cherry No. 2175, hardwood lined blade with black walnut head No. 2181 fixed, No. 2181A movable; mahogany, ebony lined blade No. 2184 fixed, No. 2184A movable head; and No. 2188 with tapered blade. We also make the transparent, amberine lined T Squares, with maple blades and black walnut heads, No. 2192 is fixed, No. 2193 shifting double head. Steel T Squares also carried in stock.

United States Blue Print Paper Co., 201-207 South Wabash Avenue, Chicago, Ill.

Wickes Brothers

Established 1856
Saginaw, Mich.

Sales Offices: 501 Fifth Ave., New York, N. Y.

736 White-Henry Bldg., Seattle, Wash.

Sales Agents: A. Lietz Co., Los Angeles and San Francisco, Calif.

Manufacturers of

Blue Printing Equipment

Modern School Drafting Room Equipment

The modern conception of the purpose of a school course is to acquaint students with industrial practice as well as to train them in the technique of drawing. Years ago a student might complete a course in drafting without learning the difference between various types of blue print paper—without even knowing that there was such a thing as a VanDyke. This in spite of the fact that the ultimate purpose of a mechanical drawing is the production of prints. It remained for Wickes Brothers to produce a Blue Printing Machine and other equipment so low in first cost, so economical in operation, so simple and safe to operate and so compact that the average school could see its way clear at least to teach students real industrial practice. Hundreds of schools are now using Wickes Brothers equipment in their drafting rooms.

Wickes Blue Printing Machines

Advantages—Prints made with the Wickes Blue Printing Machine are absolutely uniform in tone throughout and lines are sharp and clear. All work is done in broad daylight. There is no glass cylinder to clean, break or replace. Simple in operation. Will outprint any other machine per unit of electricity consumed.

Operation—The Wickes continuous electric blue printing machine will print separately cut sheets or continuous rolls in any length and in widths varying from 2 to 48 in. The paper and tracing, placed on a continuous traveling belt, are carried to the feed roller and around the printing cylinder in which is mounted the lighting element. The printed paper is then delivered to a light-tight storage



Wickes Continuous Electric Blue Printing Machine

compartment and the tracing is returned to the operator or carried to the storage compartment, as desired.

The machine is entirely automatic, the only work required of the operator being the placing of the tracing and blue print paper on the traveling belt. The entire operating mechanism is controlled by three toggle switches conveniently located for the operator. The operator, without changing position, can start, stop, reverse, or vary speed of drive. The entire electrical mechanism is approved by the National Board of Fire Underwriters.

Continuous Traveling Belt—The contact between tracing and paper is secured by means of a single, wide, continuous belt which passes around the feed rolls and the metallic printing cylinder. The tension of this belt is regulated automatically. Its life is guaranteed for three years' service.

Lighting Element—The light is obtained from one or two mercury vapor lamps of standard pattern. These lamps operate at a very low temperature and require absolutely no attention from the operator at any time.

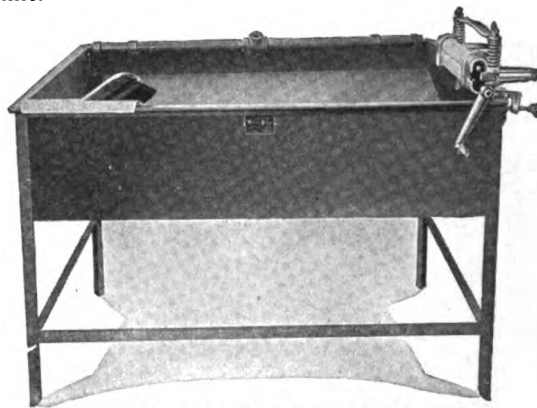
Model 20 Blue Printing Machine

The Model 20 machine carrying two lighting elements on separate starting apparatus has a liberal capacity. With the improved variable speed, 4-step, quick change gear box and adjustment of motor on iron driving disc, the printing speed can be adjusted to suit any grade of paper, including VanDyke's. The machine is entirely self-contained; is 30 in. high and requires a floor space of 2 ft. 6 in. by 5 ft.

Model 15 Blue Printing Machine

The Model 15 machine is constructed exactly like the Model 20 except that it carries only one lighting element,

decreasing the printing speed about one-half. It is so constructed that another lighting element can be added at any time as required, thus changing it to a Model 20 machine.



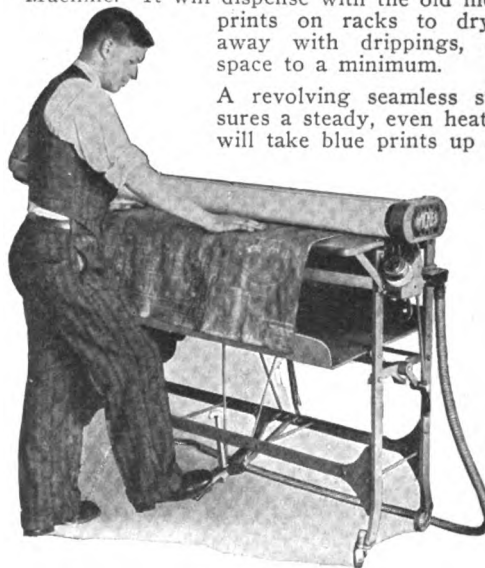
Wickes Horizontal Blue Print Washing Tank

The Wickes Washer

The Wickes Horizontal Blue Print Washer is extremely durable and is a great convenience in the drafting room as it affords a means of washing prints speedily and without muss and bother. The washing tank 36 inches x 48 inches in size is constructed of strong sheet metal on angle iron legs, with sufficient slant so water will run rapidly from prints being washed. A pipe with a gang of holes to give spray effect is mounted on the back. The chemical tray with brush is in front and the wringer is attached to the side—all within easy reach of the operator.

The Wickes Electric Dryer

This Dryer is especially recommended for use in connection with the Wickes Continuous Electric Blue Printing Machine. It will dispense with the old method of hanging prints on racks to dry thereby doing away with drippings, conserving floor space to a minimum.



Wickes Electric Dryer in Operation

A revolving seamless steel cylinder insures a steady, even heat at all times. It will take blue prints up to 48" wide, unlimited lengths.

Prints may be dried continuously without stopping and starting dryer. A wide hard maple feed board leads to the rolls.

It is as nearly automatic as possible. One pressure of the foot lever puts the whole machine in operation. No levers to work—no

buttons to push on and off, both hands being always free to handle prints being dried. It has a powerful motor, and operates without noise or vibration. It is sturdily built, the frame being of rigid, indestructible channel iron finished in enamel.

Catalogs

Catalogs fully describing the Wickes blue printing equipment will be sent on request.

Wickes Brothers, Saginaw, Mich.

W. M. Welch Manufacturing Company

Laboratory Furniture Factory
Manitowoc, Wisconsin, U. S. A.

General Office and Scientific Apparatus Factory
1516 Orleans St., Chicago, U. S. A.

Manufacturers of Laboratory, Vocational, Library Furniture, Apparatus and Supplies

Sales Representatives in Principal Cities

Mechanical and Art Room Furniture

All lumber used in Welch furniture is especially selected and dried in vapor kilns. With regard to the construction of the mechanical drawing and art room furniture, please note the following. All exterior body work is built of selected White Oak. Interior work is of hardwood, that is, Oak, Birch, and Cypress. Tops are built up of strips, tongued and grooved together, and slanted to a proper degree by the Welch patent adjustor, or by stationary construction.

All drawers have full framed construction, with laminated bottoms and lapped fronts. The back, outside and inside of ends are panelled with three ply stock. Finish, standard or special, as desired. In many cases, we match the wood trim of the building. More detailed specifications of each item will be found in catalog pages. See Catalog F.

No. 9520 Mechanical Drawing Table



Top measures 36" long by 25" wide; 37" high at front and 40" high at rear. Accommodates three students working at different periods. Compartments admit drawing boards 18"x 24". Upper section of compartments for instruments, 8" high by 2½" wide. Built of selected Oak.

No. 9520—As illustrated, WITHOUT LOCKS, Shpg. Wt., 150 lbs.
No. 9521—Same as No. 9520, but WITH LOCKS, Shpg. Wt., 150 lbs.

No. 9601 Drawing and Art Table

Top measures 34" long by 20" wide and is 30" high. Adjustable section, 24" long by 20" wide. Accommodates three students at different periods. Compartment takes drawing boards 16"x 22". Instrument lockers measure 4" high, 2¾" wide, and 12" deep. One general drawer 16"x 16"x 2½" deep.



No. 9601—As illustrated, WITH LOCKS, Shpg. wt., 150 lbs.
No. 9611—40" long by 20" wide; six individual drawers WITH LOCKS and one large cupboard without lock. Shpg. wt., 180 lbs.

No. 9550 Mechanical Drawing Board and Instrument Cabinet



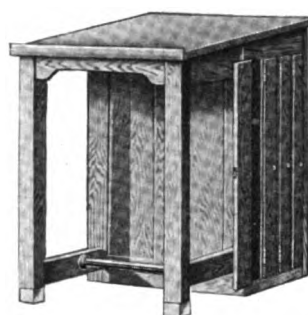
42" long, 23" front to back and 72" high. Upper section accommodates 24 drawers 5¼" wide, 15¾" front to back and 4" deep. Lower section provides storage for 24 boards 18"x 24". Outer door equipped with lock.

No. 9550—As illustrated, Shpg. wt. 400 lbs.

Other Welch Products

The W. M. Welch Manufacturing Company, in addition to Mechanical Drawing and Art-Room Furniture, manufacture a complete line of library, laboratory, domestic science, and general school furniture. Welch scientific equipment and chemicals are nationally known and used for Physics, Chemistry, Electrical Science, Biology, Agriculture, and General Science courses. Refer to the standard Welch catalogs which will be sent on request.

No. 9501 Mechanical Drawing Table



Perry-Milwaukee Design. 39" long, 28" wide, 38" high at front and 41½" high at back. Four compartments on each side of table, accommodating eight students. Compartments take boards 18"x 24". Instrument compartment measures 2¾" wide by 6½" high.

No. 9501—As illustrated, WITH LOCKS, Shpg. wt., 240 lbs.
No. 9502—Like No. 9501, furnished WITH HASPS BUT WITHOUT PADLOCKS, Shpg. wt. 240 lbs.
No. 9503—Same as No. 9502, but WITH PADLOCKS.

No. 9612 Art Table

Top measures 34" long by 20" wide and is 30" high. Adjustable top, 24" long and 20" wide. Single general drawer at right side.

No. 9612—As illustrated, Shpg. wt. 90 lbs.



No. 9634 Instructor's Drawing Table

Top measures 72" long, 34" wide and 36" high. Two top drawers are 18" wide, 25" front to back and 5" deep. The six bottom drawers are 37½" wide, 25" front to back and 2½" deep. Pipe foot rail below knee space.

No. 9634—As illustrated, WITHOUT LOCKS, Shpg. wt. 350 lbs.
No. 9635—Same as No. 9634, but WITH LOCKING DEVICE which locks all drawers with one lock. Shpg. wt. 350 lbs.
No. 9636—Same dimensions as No. 9634, but with one 16" wide drawer and two 37" wide drawers, WITHOUT LOCKS, Shpg. wt. 180 lbs.
No. 9637—Same as No. 9636, but WITH LOCKS, Shpg. wt. 180 lbs.



Square Leg and Revolving Stools



No. 1012—Heavy Square Leg Stool, 24" high, Golden Oak. Shipping weight 9 lbs.



No. 1016—Revolving Stool. Seat 13" in diameter and 26" high. Shipping weight 16 lbs.

Refer to Welch Specifications in the Woodworking Section

Shop Building Floor Plan Details:

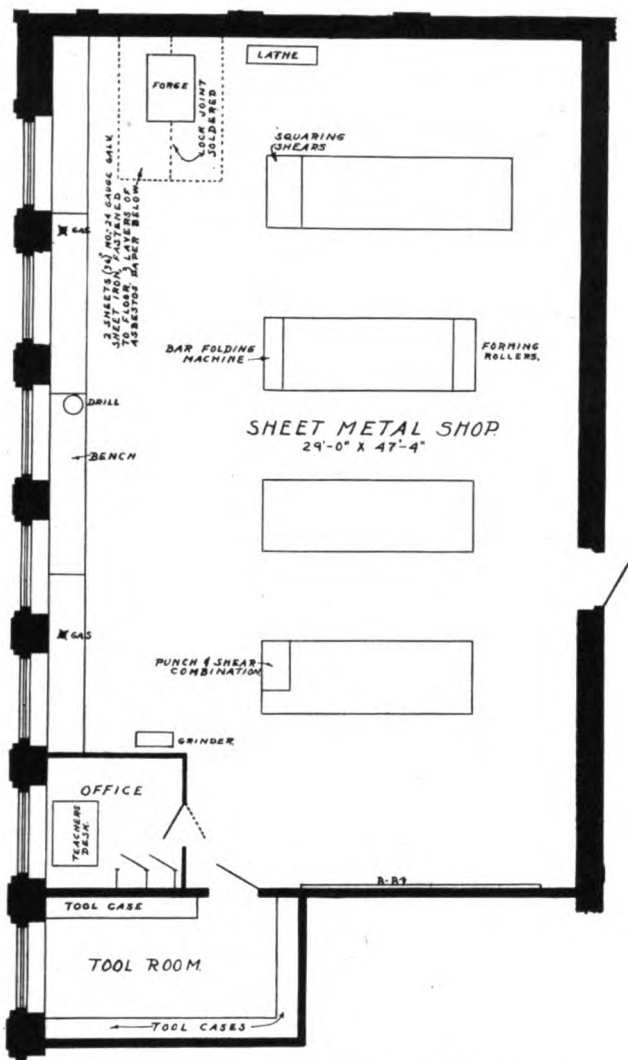
- Top Wall:** 12'-0" Sunk with VARIOUS JACOETS. 6'-0" B.B. (Flush Tank).
- Left Wall:** 24' x 18'-0" Work Bench. 36' x 18'-0" Stock and Soldering Bench. Solder Furnace 1/2" OUTLET. Sound No. Resistant.
- Center Area:** 24' x 12'-0" Plumbing Work Bench. 36' x 18'-0" Work Bench. 36' x 14'-0" Layout Bench. 24' x 36'-0" Work Bench.
- Right Wall:** 12'-0" Sunk with VARIOUS JACOETS. 6'-0" B.B. (Flush Tank). TOOL ROOM (Special steel Equipment). SUPPLY ROOM (Special steel Equipment).
- Bottom Wall:** 12'-0" Sunk with VARIOUS JACOETS. 6'-0" B.B. (Flush Tank).
- Other Features:** 36' x 18'-0" Work Bench. 36' x 14'-0" Layout Bench. 24' x 36'-0" Work Bench. 12'-0" Sunk with VARIOUS JACOETS. 6'-0" B.B. (Flush Tank).

Floor plan of the main hall for the 1964-65 season. The hall is rectangular with a stage at the top. The stage area includes a 'PLATFORM' with '40 SEATS', a 'DEMONSTRATION BENCH', a 'PLATE' table, a 'SMALL TABLE', a 'FOLDER', a 'CIR. SEAT', a 'CLOSET', and a 'WALL ALL'. The main seating area is filled with 'BENCHES'. At the bottom, there is a 'LAVATORY' and a 'STAGE' area with a 'BENCH' and a 'CLOSET'.

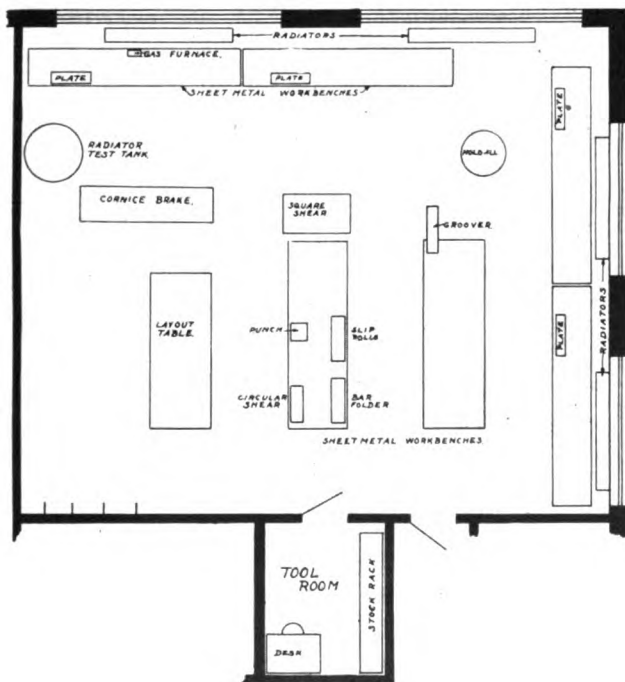
A detailed floor plan of a workshop. The layout includes a 'TOOL ROOM' on the left, a 'WORKING SHOP' area with a 'TOOL' and 'GRINDER', and a 'WORK BENCH AND DISPLAY SHELF' with a 'CONCRETE SAW'. The central area features a 'SINK', a 'SHARPEN' station, a 'HOLDS BENCH', and a 'WORK BENCH' with a 'TOOL'. The right side contains a 'BATH', a 'FURNACE', and a 'WORK BENCH' with a 'TOOL'. The bottom section includes a 'LATHE', 'TIN SINK', 'SOLDERING BENCH', 'SOLDERING IRON HOLDERS', and a 'RADIATOR'. A 'BRICKER DRIVEN' area is also indicated.

A detailed floor plan of a mechanical workshop. The layout includes a central work area with several labeled components: a 'Soldering Furnace' on the left, a 'Soldering Benches' area at the top, and a 'Wash-Room' on the right. In the center, there is a 'Conical Stake' and a 'Stake Bench'. To the right of the central area is a 'Chair Platform'. The bottom of the plan shows a 'Tool Case' and a 'Blackboard' on the left wall. The plan also indicates the location of 'Vices', 'Brick and Flux Pan', 'Bar Folder', 'Groover', 'Holdall Revolving Machine Stand', and 'Skip Roll Forming' machines. The entire workshop is enclosed by a thick black border representing the walls.

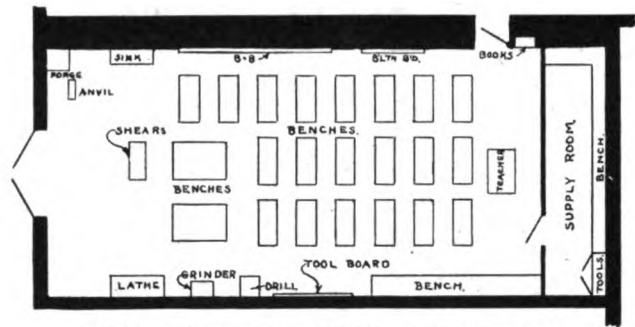
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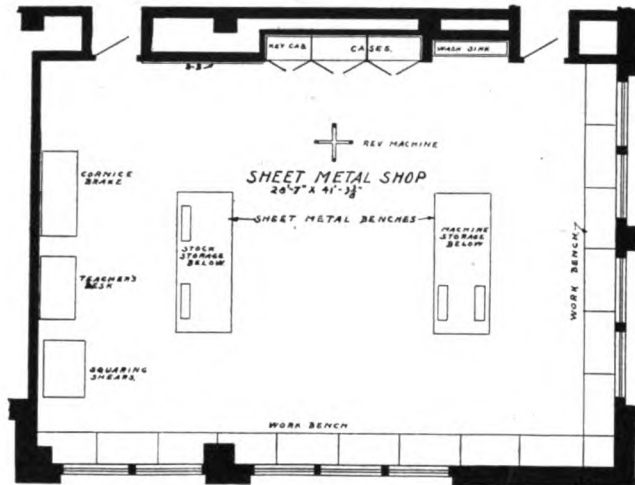
THOS. JEFFERSON JUNIOR HIGH SCHOOL,
CLEVELAND, OHIO



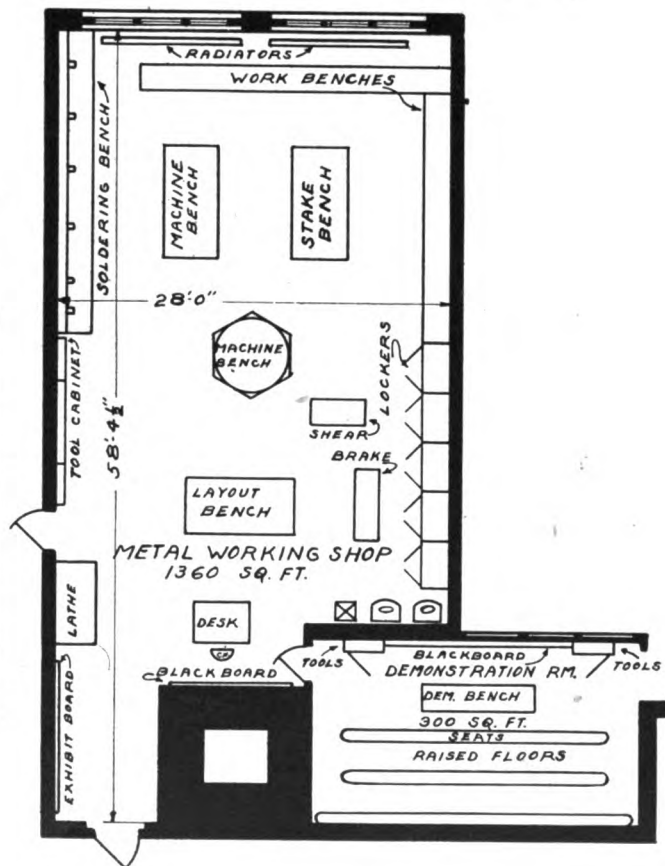
SHEET-METAL SHOP, BENJAMIN FRANKLIN JR. HIGH
SCHOOL, NEW CASTLE, PA.



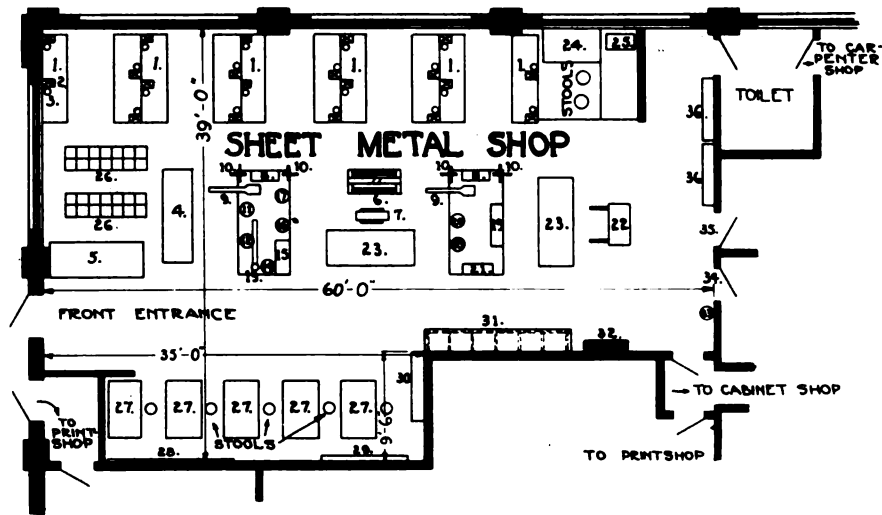
SHEET-METAL SHOP, JUNIOR HIGH SCHOOL,
LOUISVILLE, KY.



JUNIOR HIGH SCHOOL, CHICAGO, ILL.

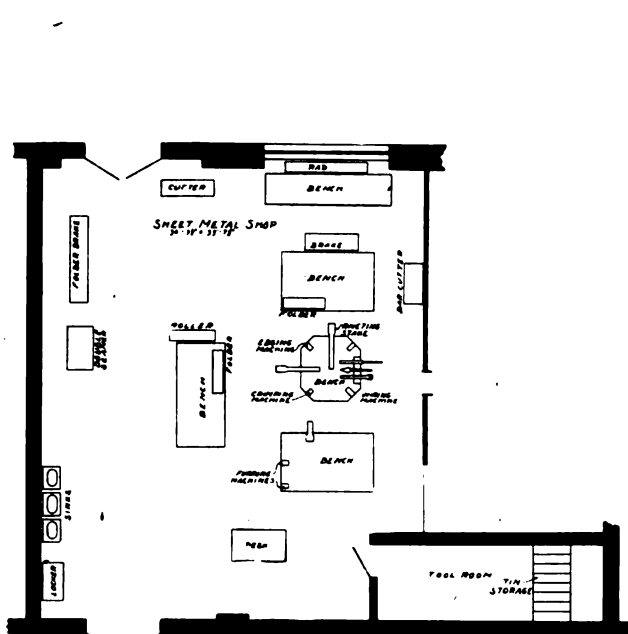


TYPICAL JUNIOR-HIGH-SCHOOL SHEET-METAL SHOP,
MINNEAPOLIS, MINN.

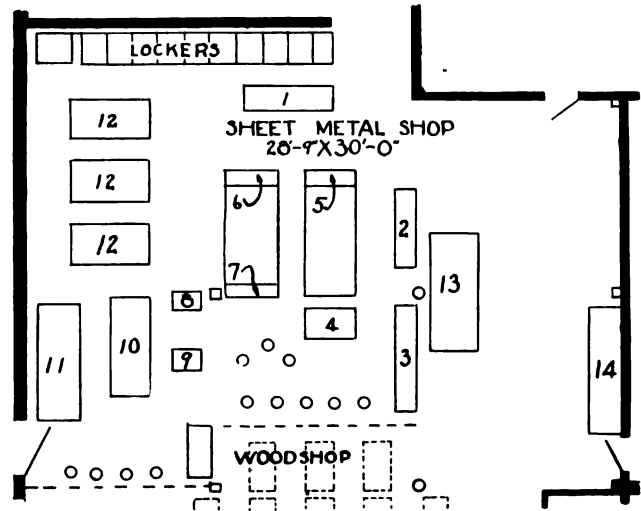


JOHN C. FREMONT HIGH SCHOOL, LOS ANGELES, CALIF.

- | | | | |
|-------------------|---------------------------|---------------------------|-----------------------|
| 1. Workbenches | 10. Vises | 19. Circular Shears | 28. Blackboard |
| 2. Fire Pots | 11. Crimper | 20. Small Burring Machine | 29. Switch Box |
| 3. Acid Jars | 12. Wiring Machine | 21. Rolls | 30. 6 Steel Lockers |
| 4. 8" Brake | 13. Grooving Machine | 22. Squaring Shears | 31. 6 Wooden Lockers |
| 5. Sheet Rack | 14. Double Seamer | 23. Cutting Benches | 32. Radiator |
| 6. Stake Horse | 15. Bar Folder | 24. Special Drawing Table | 33. Drinking Fountain |
| 7. Anvil | 16. Beading Machine | 25. Filing Cabinet | 34. Toolroom |
| 8. Bench Plates | 17. Small Turning Machine | 26. Steel Lockers | 35. Office |
| 9. Hollow Mandrel | 18. Rotary Shears | 27. Drawing Tables | 36. Wash Troughs |

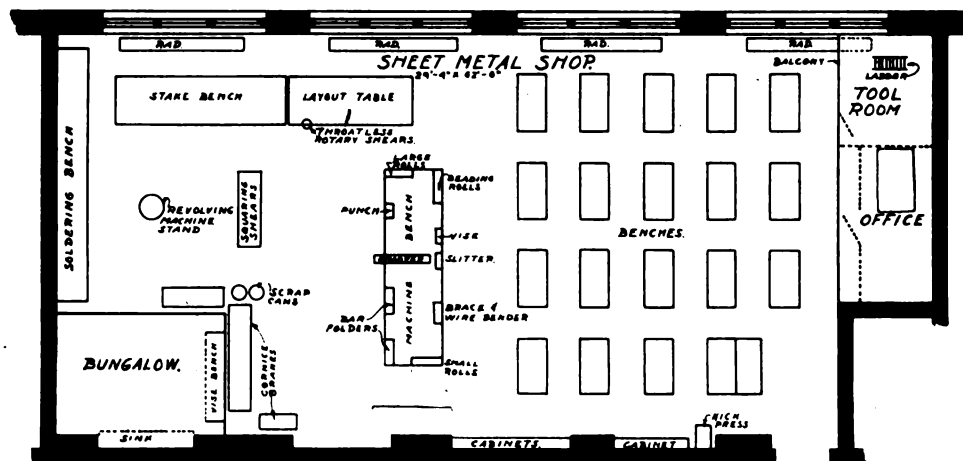


SHEET METAL AND WELDING SHOP, LATHROP TRADE SCHOOL, KANSAS CITY, MO.



SHEET-METAL SHOP, MANITOWOC VOCATIONAL SCHOOL, MANITOWOC, WIS.

- | | |
|--------------------|---------------------|
| 1. Brake | 8. Grinder |
| 2. Tool Cabinet | 9. Drill Press |
| 3. Metal Rack | 10. Layout Bench |
| 4. Square Shears | 11. Soldering Bench |
| 5. Circular Shears | 12. Drawing Tables |
| 6. Folder | 13. Lumber Storage |
| 7. Former | 14. Pattern Cabinet |



MILWAUKEE VOCATIONAL SCHOOL, MILWAUKEE, WIS.

Sheet-Metal Equipment

Major Equipment and Small Tools

20 Students Per Class

Name and Description	Junior High School	Senior High School	Technical High and Full-Time Vocational Schools	Part-Time Vocational School
Bar Folder				
20" size.....	1	1	1	1
30" size.....	1	1	1	1
Beading Machine	1	1	1	1
Beam Compass	1	1	1	1
Benches , for sheet-metal work, with iron or steel legs. Tops of metal or hardwood lumber, 1¾" to 2½" thick...	6	6	6	6
Bench				
Grinder, hand or power....	1	1	1	1
Plates	3	3	3	3
Punch	0	1	1	1
Vise, 5".....	2	2	3	3
Blackboard , permanent or portable		1 or more		
Blackboard Drafting Outfit for the teacher	1	1	1	1
Bookcase , for reference books, catalogs, etc.....		1 or more as required		
Brooms and Floor Brushes ...	4	4	4	4
Brushes , counter.....	12	12	12	12
Bulletin Board		1 or more		
Burring Machine				
Large	1	1	1	1
Small	2	2	3	3
Cabinets , wood or metal for filing class records, instruction sheets, drawings, etc...		1 or more as required		
Chairs , tablet-arm.....		As required		
Circumference Rules	3	3	4	4
Cold Chisels	2	2	2	2
Corner Crimper	0	0	1	1
Cornice Brake				
6'.....	0	1	1	1
8'.....	0	0	1	1
Crimping Machine	1	1	1	1
Cutting Nippers , pair.....	2	2	2	2
Desk				
Teacher's, with drawer compartments	1	1	1	1
Chair, to match desk.....	1	1	1	1
Dividers , 10", pair.....	12	12	12	12
Double Seaming Machine	0	1	1	1
Drawing Boards				
24".....	20	20	20	20
48".....	1	1	1	1
Drawing Instruments , sets...	10	10	10	10
Drills , jobbers, selected sizes, each	3	3	3	3
Elbow Edging Machine , with turning rolls.....	1	1	1	1
Electric Drill , ½", with stand.	1	1	1	1

Use post-card service for special information

Name and Description	Junior High School	Senior High School	Technical High and Full-Time Vocational Schools	Part-Time Vocational School
File Card	3	3	3	3
Files, flat bastard, 12".....	12	12	12	12
First-Aid Cabinet and Supplies	1	1	1	1
Forming Machine, slip roll				
20" size	0	0	1	1
30" size	1	1	1	1
Furnace, gas.....	6	6	6	6
Gas Lighters.....	12	12	12	12
Glass Tumblers, for flux.....	6	6	6	6
Hack Saw				
Blades, hand, 18T, 10", doz.	3	3	3	3
Frames, adjustable	3	3	3	3
Hammers				
Raising	2	2	2	2
Riveting, $\frac{7}{8}$ ".....	10	10	10	10
Riveting, 1 $\frac{1}{2}$ -lb.....	2	0	0	0
Riveting, 2 $\frac{1}{2}$ -lb.....	0	2	2	2
Setting, $\frac{3}{4}$ ".....	10	10	10	10
Hand Groovers, sets	2	2	2	2
Irregular Curves, selected sizes, each	1	1	1	1
Jars, stone, 1-gal. capacity....	4	4	4	4
Mallets, hardwood or hard rubber	12	12	12	12
Marble Slabs	6	6	6	6
Melting Ladle, 5" bowl.....	1	1	1	1
Oil Can				
$\frac{1}{2}$ -pt. size	1	1	1	1
1-gal. size	1	1	1	1
Pliers, flat jaw, 8", pair.....	12	12	12	12
Punches				
Hand	1	1	1	1
Hollow, sets	2	2	2	2
Prick	12	12	12	12
Solid, sets	2	2	2	2
Scales				
Draftman's	10	10	10	10
Steel, 12", graduated to 16ths	12	12	12	12
Scratch Awls	12	12	12	12
Scrapers, plumbers.....	6	6	6	6
Screw Drivers				
6" size	2	2	2	2
12" size	2	2	2	2
Setting-Down Machine.....	0	1	1	1
Shears				
Bench	0	1	1	1
Slitting Machine	0	0	1	1
Squaring, 30".....	0	1	1	1
Throatless	0	1	1	1
Snips				
2 $\frac{1}{2}$ " cut, pair.....	6	0	0	0
3" cut, pair.....	6	12	12	12
3" cut, right-hand cut for left-hand man, pair.....	2	2	2	2
Curved-blade, pair	2	2	2	2
Compound, pair	0	0	1	1
Hawkbill, pair	1	1	1	1
Slitting, pair	0	0	1	1
Trojan, pair	0	0	1	1
Soldering Coppers				
2-lb., pair	3	3	3	3
3-lb., pair	3	3	3	3

See classified directory for sources of supply

Name and Description	Junior High School	Senior High School	Technical High and Full-Time Vocational Schools	Part-Time Vocational School
Squares				
Steel, 12"	12	12	12	12
Steel, 24"	1	1	1	1
Stakes				
Beakhorn	1	1	1	1
Bevel-edge, square.....	1	1	2	2
Blowhorn	1	1	2	2
Bottom	0	1	1	1
Candle-mold	1	1	1	1
Conductor	1	1	1	1
Creasing	1	1	1	1
Double-seaming	2	1	1	1
Double-seaming, with removable heads	0	1	1	1
Hatchet	1	1	1	1
Hollow-mandrel	1	1	1	1
Needle-case	1	1	1	1
Round-head	1	1	1	1
Solid-mandrel	0	1	1	1
Straightedge, steel, 96".....	0	1	1	1
T Square				
24" size	10	10	10	10
40" size	1	1	1	1
Tongs, roofing, pair.....	0	0	1	1
Trammel Points, pair.....	1	1	1	1
Triangles				
30-60 deg., 10".....	10	10	10	10
30-60 deg., 12".....	1	1	1	1
45-deg., 8".....	10	10	10	10
45-deg., 12".....	1	1	1	1
Turning Machine				
Large	0	1	1	1
With elbow-edging rolls....	1	1	1	1
Wiring Machine	1	1	1	1
Wire				
Gauge, U. S. Standard.....	1	1	1	1
Reels	3	3	5	5
Wrenches, 10", monkey.....	1	1	1	1

Sheet-Metal Supplies

20 Students Per Class

Name and Description	Junior High School	Senior High School	Technical High and Full-Time Vocational Schools	Part-Time Vocational School
Acid Swabs, gross.....	1	1	1	1
Detail Paper, 36" wide, 25-yd. rolls	2	3	4	4
Drawing Pencils, 4H., doz....	6	6	6	6
Ears				
Wrought, No. 20, gross.....	0	1	1	1
Wrought, No. 40, gross.....	0	1	1	1
Wrought, No. 60, gross.....	0	1	1	1
Erasers, doz.....	4	4	4	4
Handles				
Ash-can, tinned, 4", doz....	0	6	6	6
Dish-pan, tinned, 3", doz....	0	2	2	2
File	24	24	24	24
Lard-can, drop, 3½", doz....	0	6	6	6
Lid, 3½", doz.....	0	6	6	6
Soldering-copper	24	24	24	24
Hinges, hasps, and other supplies required by the problems in the course.....			As required	

Use post-card service for special information

Name and Description	Junior High School	Senior High School	Technical High and Full-Time Vocational Schools	Part-Time Vocational School
Knobs, enameled teapot, No. 53, with rivets, gross.....	0	1	1	1
Lead, for punching blocks, 50-lb. pig	1	1	1	1
Lid Handles, 3½", doz.....	0	0	6	6
Pail Woods, enameled, 4", gross	0	1	1	1
Rivets, tinnners				
10-oz. boxes	1	0	0	0
12-oz. boxes	0	2	2	2
1-lb. boxes	1	2	2	2
1½-lb. boxes.....	2	6	6	6
3-lb. boxes	1	1	1	1
5-lb. boxes	0	1	1	1
8-lb. boxes	0	1	1	1
Sal Ammoniac, compressed, ½-lb. cakes	12	12	12	12
Screws				
Sheet-metal				
½"x¾", boxes	0	1	1	1
¾"x¾", boxes	0	1	1	1
Zinc-can				
¾", gross	0	1	1	1
1¼", doz.	0	2	2	2
2", doz.	0	2	2	2
Sheet				
Brass, 28 to 32 American gauge, 12" wide by 72" to 84" long. Selected sizes, sheets, each	0	0	2	2
Copper, 16-oz., 30"x96", sheets	0	1	2	2
Steel, black, 30"x96", 26 gauge, bundles.....	0	1	1	1
Steel, galvanized				
30"x96", 20-gauge, bundles	0	1	1	1
30"x96", 24-gauge, bundles	0	1	1	1
30"x96", 26-gauge, bundles	1	1	1	1
30"x96", 28-gauge, bundles	2	1	1	1
Zinc, No. 27, 30"x96", sheets	0	1	1	1
Solder, bar, half-and-half, lb..	50	100	100	100
Soldering Flux, gal.....	1	1	1	1
Stove Bolts				
F.H., ½"x1", box.....	1	1	1	1
F.H., ¾"x1", box.....	1	1	1	1
F.H., 1"x1", box.....	1	1	1	1
R.H., ½"x1", box.....	1	1	1	1
R.H., ¾"x1", box.....	1	1	1	1
R.H., 1"x1", box.....	1	1	1	1
Thumb Tacks, boxes of 100 each	5	5	5	5
Tin Plate				
1C, and IX, 20"x28", charcoal and coke, boxes each.	1	1	1	1
Wire				
Coppered, No. 10, roll.....	0	0	1	1
Coppered, No. 12, roll.....	0	0	1	1
Galvanized, No. 10, roll....	1	1	1	1
Galvanized, No. 12, roll....	1	1	1	1
Galvanized, No. 14, roll....	1	1	1	1
Stove pipe, No. 18, roll.....	1	1	1	1

See classified directory for sources of supply

Niagara Machine & Tool Works

Buffalo, N. Y.

Manufacturers of

NIAGARA

Machines and Tools for Sheet Metal Working

All improvements of real value developed during fifty years' experience in building machines and tools for sheet metal working are incorporated in Niagara Machines. Strength, rigidity, long life, modern design and reliability are outstanding features. Niagara Machines are particularly adapted to school use. The following tabulation gives five suggested equipment lists, for various types and sizes of classes. Page references are to Catalog No. 56. Copy furnished on request. Floor plans and detailed equipment lists are given in Circular No. 103. Write for copy.

LIST NO. 1 is suggested for Vocational Schools and will accommodate a class of twenty to twenty-five students. Equipment listed costs about \$1,800.00.

LIST NO. 2 is suggested for Technical or Senior High Schools and will accommodate a class of fifteen to twenty students. Equipment listed costs about \$1,220.00.

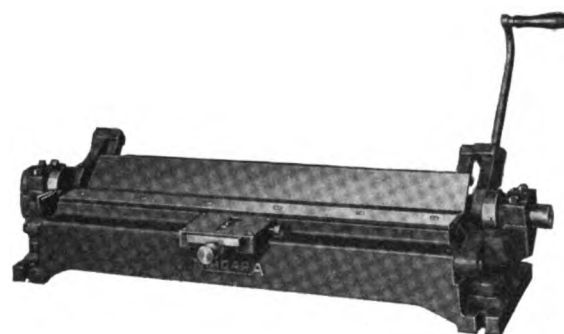
LIST NO. 3 is suggested for Junior High Schools devoting a separate shop to sheet metal working. Equipment listed would accommodate a class of ten to fifteen students and cost about \$785.00.

LIST NO. 4 is suggested for Industrial Arts and Manual Training courses. Equipment listed costs about \$420.00.

LIST NO. 5 is also recommended for Industrial Arts courses or for composite shops. Equipment listed costs about \$240.00.

Bench Machines

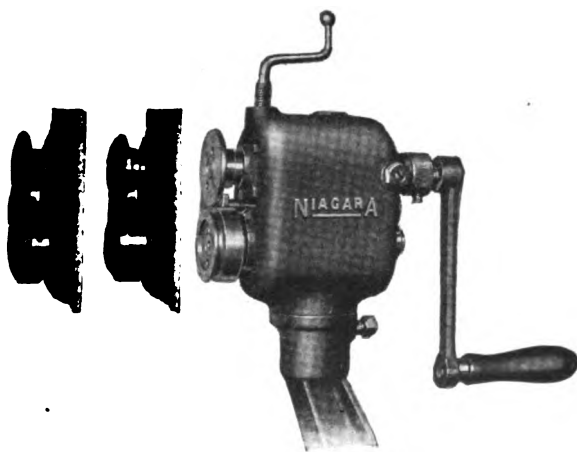
No.		Page No.	List No.				
			1	2	3	4	5
No. 2	21" Niagara Adjustable Bar Folder....	7	1				1
No. 3	30" Niagara Adjustable Bar Folder....	7	1	1	1	1	
No. 4	36" Niagara Adjustable Bar Folder....	7	1				
No. 48	30" Niagara Adjustable Pipe Folder....	11	1				
No. 131C	Niagara Combination Bench Machine with stand.....	17B					1
No. 131B	Niagara Burring Machine with stand...	17B	2	1	1	1	
No. 131T	Niagara Turning Machine with stand...	17B	2	1	1	1	
No. 131W	Niagara Wiring Machine with stand...	17B	2	1	1	1	
No. 138	Buffalo Small Burring Machine with stand.....	21	1				
No. 140	Buffalo Elbow Edger with stand.....	21	1	1			
No. 156	Superior Setting Down Machine with stand.....	24	1	1	1		
No. 185	Niagara Crimper and Beader with stand.....	28	1	1			
No. 194	Niagara Beader with stand.....	30B	1	1	1	1	1
	Crimping Rolls (pair) for No. 194 Beader.....				1	1	
No. 255	20" Buffalo Groover.....	43					1
No. 258	30" Niagara Groover (No. 2).....	43		1	1		
No. 259	36" Niagara Groover (No. 2).....	43	1	1	1		
No. 280	Moore's Double Seamer, with stand.....	47	1	1	1		
No. 330	2"x30" Niagara Slip Roll Former.....	56A		1	1	1	1
No. 331	2"x36" Niagara Slip Roll Former.....	56A	1				
No. 438	Niagara Wire Straightener for hand.....	63	1				
No. 440	Niagara Wire Cutter and Bail Former.....	63	1				
No. 854	30" Niagara Adjustable Gutter Beader.....	86	1	1			
No. 914	Niagara Ring and Circle Shear (No. 11).....	91	1	1	1		
No. 972	Niagara Lever Punch (No. 14).....	104	1				
No. 996	Niagara Combined Shear and Punch (No. 3).....	108	1				
No. 1012	Niagara Scroll Shear (No. 1).....	109	1				
	Stationary Vise—4" Jaw.....		1	2	1		
	Stationary Vise—5" Jaw.....		1				
	Throatless Shear—No. 18 Gage.....		1				



No. 3. Niagara Adjustable Bar Folder

Floor Machines

No.		Page No.	List No.				
			1	2	3	4	5
No. 937	30" Queen City Foot Shear—No. 18 Gage.....	98		1	1		
No. 938	36" Queen City Foot Shear—No. 18 Gage.....	98	1				
	8 ft. Steel Cornice Brake—No. 18 Gage.....		1	1			
	Niagara Hexo-Bench.....	17A	2	1	1	1	1



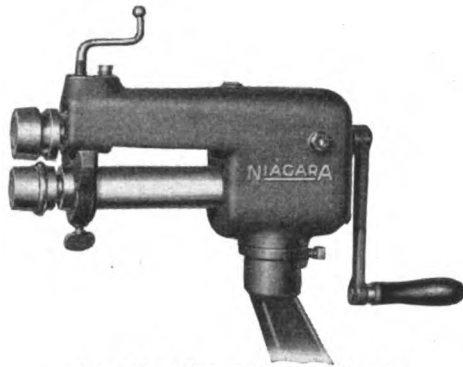
No. 131-C. Niagara Combination Bench Machine



No. 938. Queen City Foot Shear

Niagara Machine & Tools Works, Buffalo, N. Y.

Niagara Machine and Tool Works, Continued



No. 194. Niagara Beading Machine

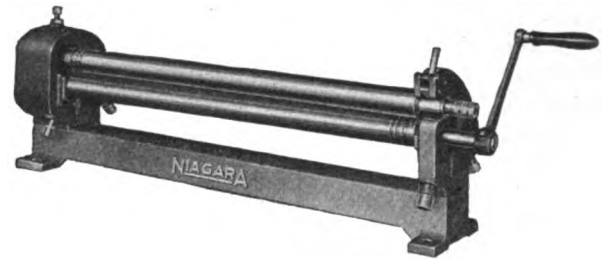
Hand Tools

Note: Quantity designated by (*)—order one for each student in class.

No.	Description	Page No.	List No.				
			1	2	3	4	5
No. 9	Niagara Straight Snips.....	75	*	*	*	6	4
No. 8	Niagara Snips R. H. cut for L. H. Man.....	75	2				
No. 018	Buffalo Circle Snips.....	76	6	4	2	1	1
No. 5	Niagara Extra Heavy Snips.....	76	2				
No. 623	Niagara Double Cutting Snips.....	77	2	1			
No. 625	8-ft. Niagara Steel Straight Edge.....	77	1				
No. 4	Niagara Bench Shear.....	78	1	1			
No. 0	Niagara Rivet Sets, $\frac{1}{4}$ " hole.....	79	1	1	1	1	1
No. 1	Niagara Rivet Sets, $\frac{1}{2}$ " hole.....	79	1	1			
No. 2	Niagara Rivet Sets, $\frac{3}{4}$ " hole.....	79	*	*	*	6	1
No. 3	Niagara Rivet Sets, 1" hole.....	79	1	1			
No. 4	Niagara Rivet Sets, $\frac{1}{4}$ " hole.....	79	1				
No. 5	Niagara Rivet Sets, $\frac{1}{2}$ " hole.....	79	1	1	1	1	1
No. 6	Niagara Rivet Sets, $\frac{3}{4}$ " hole.....	79	1				
No. 7	Niagara Rivet Sets, 1" hole.....	79	1				
No. 8	Niagara Rivet Sets, $\frac{1}{4}$ " hole.....	79	1				
No. 00	Niagara Grooving Tool, $\frac{1}{2}$ ".....	79	1				
No. 1	Niagara Grooving Tool, $\frac{3}{4}$ ".....	79	1	1			
No. 2	Niagara Grooving Tool, 1".....	79	1				
No. 3	Niagara Grooving Tool, $\frac{1}{4}$ ".....	79	1	1	1	1	1
No. 4	Niagara Grooving Tool, $\frac{3}{4}$ ".....	79	1				
No. 5	Niagara Grooving Tool, 1".....	79	1	1	1	1	1
No. 7	Niagara Grooving Tool, $\frac{1}{4}$ ".....	79	1	1			
	$\frac{3}{4}$ " Niagara Hollow Punch.....	79	1	1	1	1	1
	$\frac{1}{2}$ " Niagara Hollow Punch.....	79	1	1	1	1	1
	$\frac{1}{4}$ " Niagara Hollow Punch.....	79	1				
	$\frac{3}{4}$ " Niagara Hollow Punch.....	79	1	1	1		
	$\frac{1}{2}$ " Niagara Hollow Punch.....	79	1	1	1		
	$\frac{1}{4}$ " Niagara Hollow Punch.....	79	1				
	$\frac{3}{4}$ " Niagara Hollow Punch.....	79	1	1			
	$\frac{1}{2}$ " Niagara Hollow Punch.....	79	1	1			
	$\frac{1}{4}$ " Niagara Hollow Punch.....	79	1				
	2" Niagara Hollow Punch.....	79	1				
	$\frac{1}{4}$ " Niagara Solid Punch.....	79	2	1	1	1	1
	$\frac{1}{2}$ " Niagara Solid Punch.....	79	2	1			
	$\frac{3}{4}$ " Niagara Solid Punch.....	79	*	*	*	6	1
	1" Niagara Solid Punch.....	79	2	1	1	1	1
	$\frac{1}{4}$ " Niagara Solid Punch.....	79	2	1	1	1	1
	$\frac{1}{2}$ " Niagara Solid Punch.....	79	2	1	1	1	1
	$\frac{3}{4}$ " Niagara Solid Punch.....	79	2				
No. 756	Niagara Prick Punch.....	79	*	*	*	4	1
No. 769	Niagara Scratch Awl.....	80	*	*	*	6	4
No. 2	Niagara Raising Hammer.....	80	1				
No. 3	Niagara Raising Hammer.....	80	2	3	1		
No. 4	Niagara Raising Hammer.....	80	1				
No. 3	Niagara Riveting Hammer.....	80	*	*	*	6	4
No. 3	Niagara Setting Hammer.....	80	*	*	*	1	1
No. 788	36" Plain Steel Circumference Rule.....	81	2	2	1	1	1
No. 792	Niagara Handy Tongs.....	81	2	2	1		
	2 $\frac{1}{2}$ " Niagara Hickory Mallet.....	81	*	*	*	6	4
No. 991	Niagara Portable Lever Punch (No. 1A).....	107	2	1	1	1	1
	$\frac{3}{4}$ " Cold Chisel.....		*	*	*	4	1
	10" Wing Dividers.....		*	*	*	6	1
	6" Flat Nose Pliers.....		*	*	*	4	1
	12" Steel Rule.....		*	*	*		
	Cutting Nippers.....		2	1	1	1	1
	8" Screw Drivers.....		2	1	1		
	12" Screw Drivers.....		1				
	U. S. Std. Sheet Metal Gauge.....		1	1	1		
	12" Steel Square.....		6				
	2 ft. Steel Square.....		3	3	2	1	1
	6" Side Cutting Pliers.....		6	1			
	6" Round Nose Pliers.....		2	1	1		
	1 $\frac{1}{2}$ lb. Ball Pein Hammer.....		1	1			
	10" Monkey Wrench.....		1				

Stakes

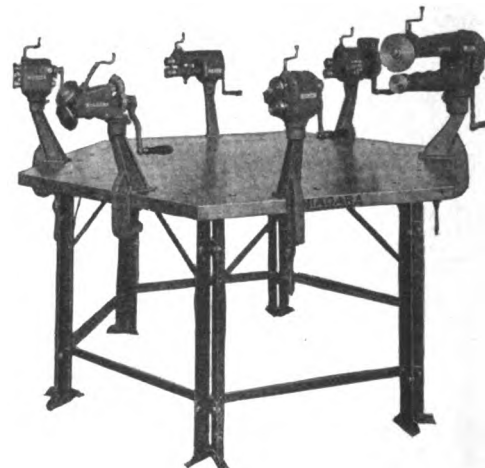
No.	Description	Page No.	List No.				
			1	2	3	4	5
No. 516	Niagara Beakhorn Stake (No. 2).....	71	1	1	1	1	1
No. 520	Niagara Double Seaming Stake (No. 1).....	71	1	1	1	1	
No. 525	Niagara Conductor Stake (No. 00).....	71	1	1			
No. 528	Niagara Blowhorn Stake.....	71	1	1	1	1	1
No. 530	Niagara Creasing Stake with horn.....	71	1	1	1	1	1
No. 532	Niagara Candlemould Stake.....	71	1	1			
No. 534	Niagara Needle Case Stake.....	71	1	1	1	1	1
No. 535	Niagara Coppersmith Square Stake.....	72	1				
No. 536	Niagara Common Square Stake.....	72	1	1	1	1	1
No. 541	Niagara Bevel Edge Square Stake (No. 2).....	72	1	1			
No. 547	Niagara Hatchet Stake (No. 3).....	72	1	1	1		
No. 548	Niagara Hatchet (No. 4).....	72	1			1	1
No. 552	Niagara Bottom Stake (No. 1).....	72	1	1	1		
No. 563	Niagara Solid Mandrel (No. 0).....	73	1	1	1		
No. 570	Niagara Round Head Stake.....	73	1	1			
No. 572	Niagara Double Seaming Stake with four heads.....	73	1	1			
No. 575	Niagara Hollow Mandrel (No. 0).....	73	1	1	1	1	1
No. 584	Niagara Bench Plate, 8"x37" (No. 1).....	74	4	3	2	1	1



No. 330. Niagara Slip Roll Former

Soldering Equipment

No.	Description	Page No.	List No.				
			1	2	3	4	5
	Double Burner Gas Furnaces.....		6	6	4	2	1
	Soldering Coppers (pairs), 3 lb. per pair.....		6	6	4	2	1
	Soldering Coppers (pairs), 5 lb. per pair.....		1				
	Soldering Copper Handles.....		14	12	8	4	2
	Acid Cups.....		6	6	4		
	Stone Dipping Solution Jars.....		6	6	4		
	Acid Brushes.....		6	6	4		
	Soldering Scrapers.....		6	6	4		
	Wire Brushes.....		2				



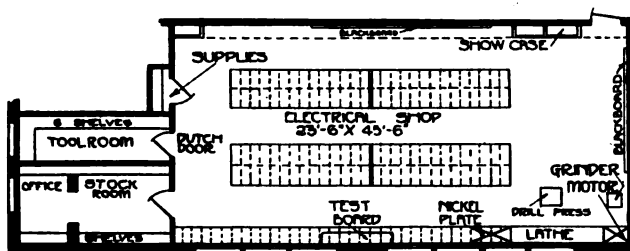
Niagara Hexo-Bench

A six-sided bench particularly adapted for holding bench machines. Will accommodate six machines, giving maximum working space combined with minimum floor space. Does not require special standards for the machines. Top is made of two-inch dressed maple, and the support consists of six rigid angle iron steel legs securely tied into one solid unit. Width across flats, 5 feet. Height, 32 inches. Shipping weight, 250 pounds. Shipped knocked down complete with all necessary bolts and screws for assembling.

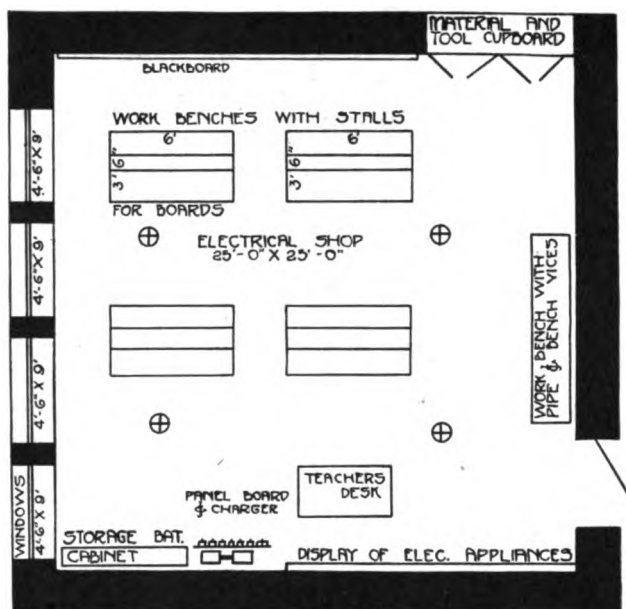
Send for catalog No. 56 and Circular No. 103.

Electrical-Shop Layouts

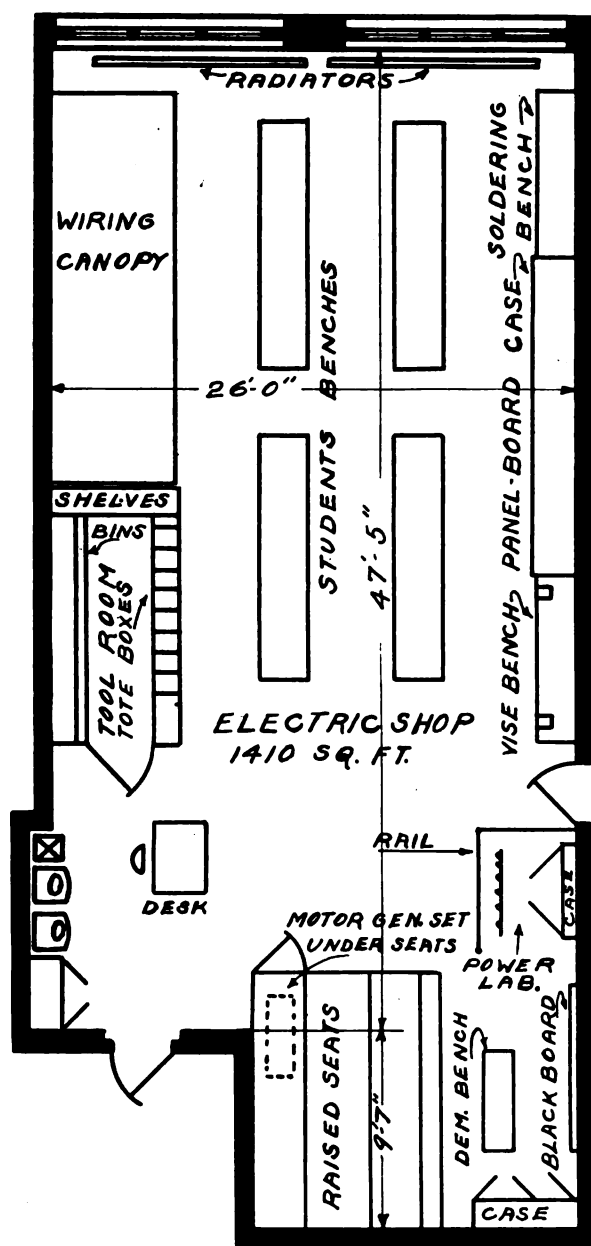
For outline of electrical course see pages 267-270
For equipment and supply lists, see pages 224-229



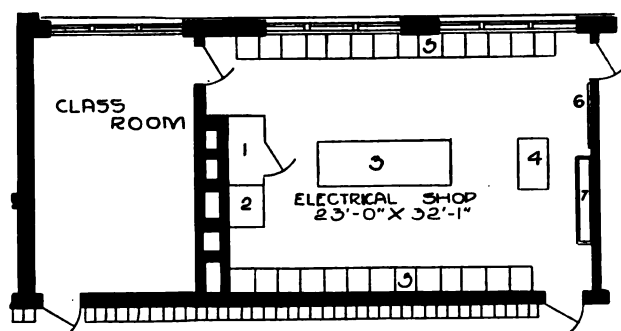
ELECTRICAL SHOP, NORTH JUNIOR HIGH SCHOOL,
EVERETT, WASH.



ELECTRIC SHOP, COCHRAN JUNIOR HIGH SCHOOL,
JOHNSTOWN, PA.

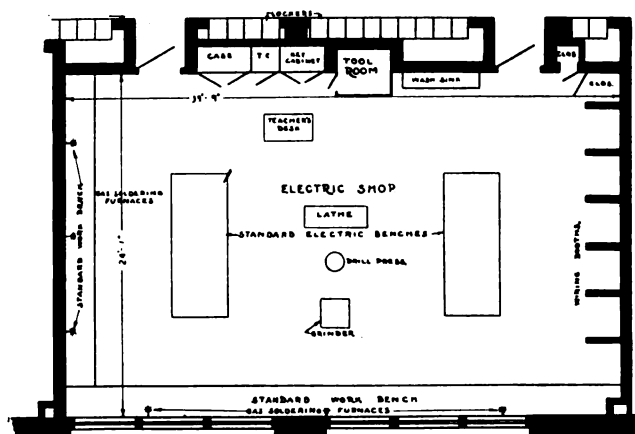


TYPICAL JUNIOR-HIGH-SCHOOL ELECTRIC SHOP,
MINNEAPOLIS, MINN.

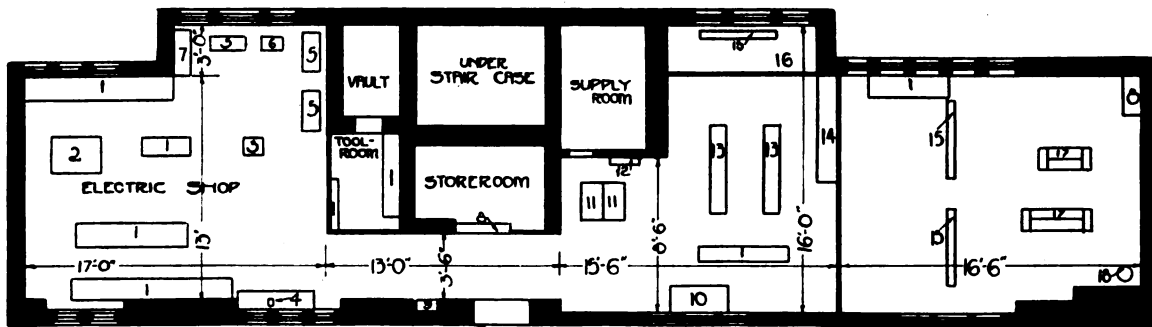


ELECTRICAL SHOP, NORMANDIN JUNIOR HIGH SCHOOL,
NEW BEDFORD, MASS.

1. Wire Grill Toolroom
2. Switchboard
3. General Workbench
4. Teacher's Desk
5. Wiring Booths
6. Blackboard
7. Wash Sink

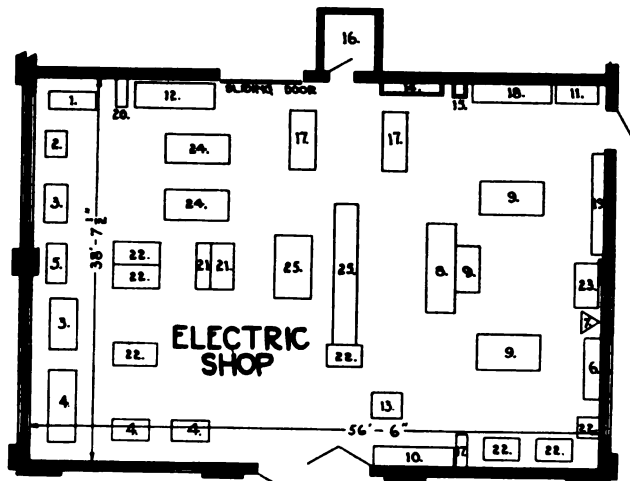


JUNIOR HIGH SCHOOL, CHICAGO, ILL.



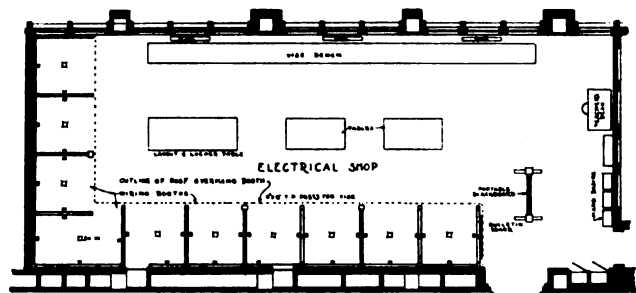
ELECTRICAL SHOP, J. STERLING MORTON HIGH SCHOOL, CICERO, ILL.

- | | | |
|--------------------|-------------------|------------------------|
| 1. Bench | 7. Supply Cabinet | 13. Motor Table |
| 2. Squaring Shears | 8. Lockers | 14. Battery Table |
| 3. Drill Press | 9. Waste Box | 15. Switchboards |
| 4. Furnace | 10. Test Table | 16. Dynamos and Motors |
| 5. Lathe | 11. Desk | 17. Telephone Racks |
| 6. Grinder | 12. Case | 18. Telephone Post |

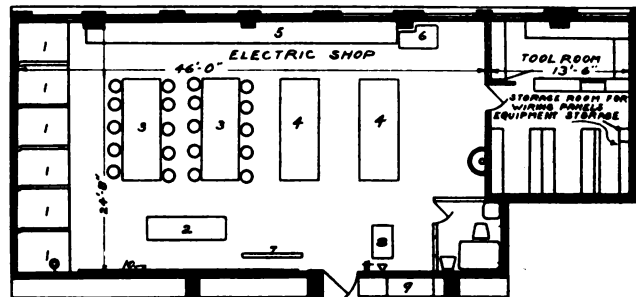


JOHN C. FREMONT HIGH SCHOOL, LOS ANGELES, CALIF.

- | | |
|-------------------------|-----------------------|
| 1. Generator, 15 h.p. | 14. Wash Trough |
| 2. Generator, 3 h.p. | 15. Slop Sink |
| 3. Generator, 5 h.p. | 16. Boys' Lavatory |
| 4. Generator, 3 h.p. | 17. Lockers |
| 5. Transformer Bench | 18. Toolroom |
| 6. Soldering Bench | 19. Stock Rack |
| 7. Welding Bench | 20. Control Switch |
| 8. Drill Press Bench | 21. Switchboard |
| 9. Workbenches | 22. Radio Tables |
| 10. Bookcase | 23. Test Lamp Table |
| 11. Wire Supply Cabinet | 24. Study Tables |
| 12. Instrument Cabinet | 25. Experiment Tables |
| 13. Teacher's Desk | |

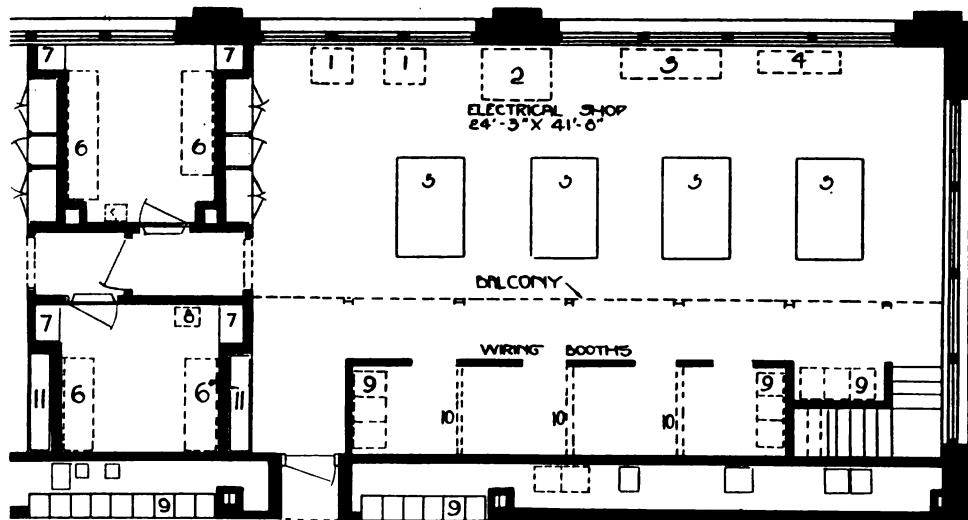


SENIOR HIGH SCHOOL, PHILADELPHIA, PA.



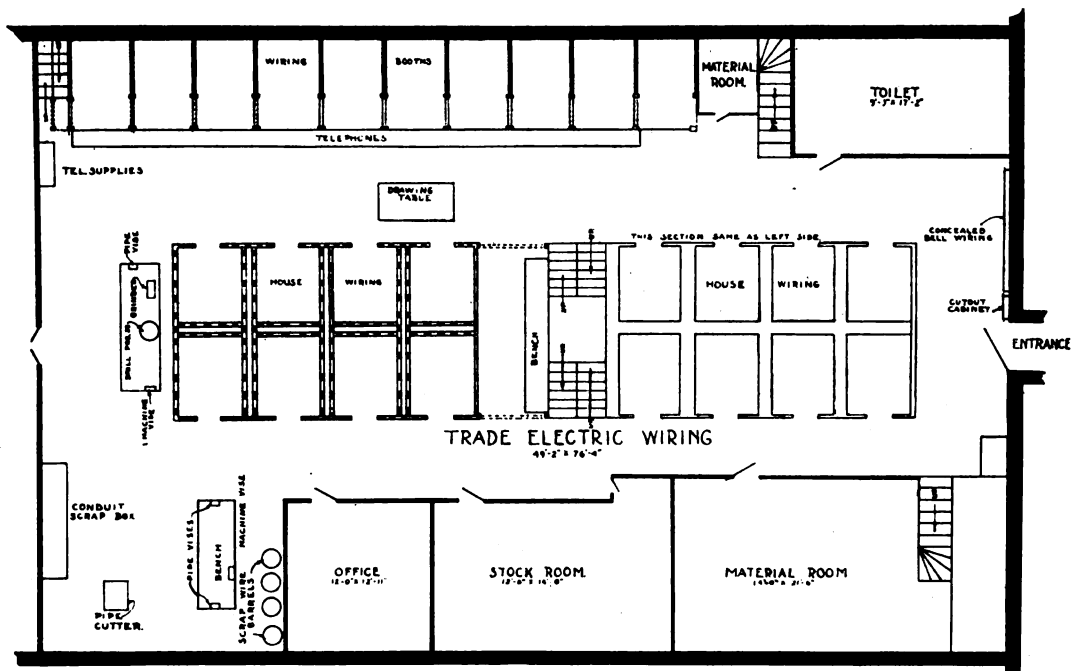
ELECTRIC SHOP, WESTERN HILLS HIGH SCHOOL, CINCINNATI, OHIO

- | | |
|-------------------------------|---------------------------------------|
| 1. Wiring Booths | 7. Switchboard |
| 2. Demonstration Bench | 8. Motor Generator |
| 3. 4' x 10' Bench with Stools | 9. Switchboard for D. C. Distribution |
| 4. 4' x 10' Bench with Stools | 10. Blackboard |
| 5. Wall Bench | |
| 6. 11" x 4' Lathe | |

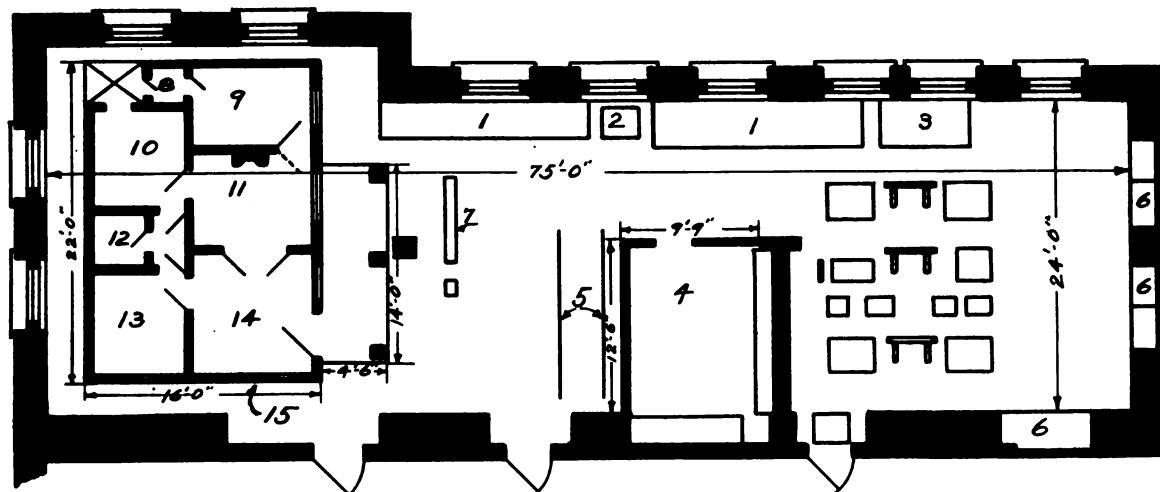


ELECTRICAL SHOP, LANE TECHNICAL HIGH SCHOOL, CHICAGO, ILL.

- | | | |
|--------------------|----------------------|-------------------------------------|
| 1. Drill Press | 5. Workbenches | 9. Lockers |
| 2. Squaring Shears | 6. Metal Stock Racks | 10. Metal Cleats on Floor for Studs |
| 3. 14" Lathe | 7. Shelves | 11. Sink |
| 4. 12" Lathe | 8. Emery Wheel | |



BOYS' TECHNICAL HIGH SCHOOL, MILWAUKEE, WIS.



VOCATIONAL ELECTRICAL DEPARTMENT, JOHN MARSHALL HIGH SCHOOL, RICHMOND, VA.

- | | | |
|------------------|---------------------------|-----------------------------------|
| 1. Workbenches | 6. Shelving | 11. 8' 6" x 8' 6" Dining Room |
| 2. Desk | 7. Lathe | 12. 4' x 4' Bathroom |
| 3. Battery Bench | 8. 3' x 3' Pantry | 13. 6' 6" x 7' 6" Bedroom |
| 4. Stockroom | 9. 8' 6" x 5' 6" Kitchen | 14. 8' 6" x 8' 6" Living Room |
| 5. Wiring Boards | 10. 6' 6" x 6' 6" Bedroom | 15. Bungalow for Wiring Exercises |

Electrical Shop

Major and Small-Tools Equipment

25 Students Per Class

Name and Description	Junior High School	Senior High School	Technical High and Full-Time Vocational Schools	Part-Time Vocational School
Bench Grinder	1	1	1	1
Benches Plain or with drawers, for tools and equipment, or with compartments for the storing of wiring panels. Preferably they should have electrical outlets.....		As required		
Bits				
Auger, $\frac{1}{4}$ " to 1" by 16ths, each	6	6	6	6
Auger, $\frac{1}{4}$ ", 18" long.....	0	24	24	24
Drill, for wood, square shank, $\frac{1}{8}$ " to $\frac{1}{2}$ ", by 16ths, each	6	6	12	12
Expansion	6	6	6	6
Extensions, 18".....	6	6	6	6
Screw-driver, $\frac{1}{4}$ ".....	6	6	6	6
Blackboard Permanent or portable.....		1 or more as required		
Blowtorches , 1-qt. size.....	12	12	12	12
Bookcase For reference books, catalogs, etc.		1 or more as required		
Braces , ratchet-type, 8" swing.	8	12	12	6
Bulletin Board		1 or more as required		
Cabinets Wood or metal, for filing class records, instruction sheets, drawings, etc.....		1 or more as required		
Chairs Tablet-arm chairs		As required		
Compass Saw	0	1	1	3
Coil				
Spreader	0	0	1	1
Taper	0	0	1	1
Winder	0	0	1	1
Desk				
Teacher's, with drawer compartments	1	1	1	1
Chair, to match desk.....	1	1	1	1
Drill				
Breast	2	2	2	2
Concrete, $\frac{3}{8}$ ", $\frac{1}{2}$ ", $\frac{3}{4}$ ", 1", each	2	3	3	3
Hand	6	6	6	6
Portable Electric	0	0	2	2
Twist, $\frac{1}{8}$ " to $\frac{3}{8}$ " by 32nds, each.....	3	6	6	12
Drill Press				
Bench, hand or power driven	1	1	1	1
Heavy, power driven.....	0	1	1	1
Files		As required		
First-Aid Cabinet and Supplies .	1	1	1	1
Hack Saw				
Blades, 10", 24 teeth per inch. Gross	1	1	2	2
Frames, adjustable.....	6	12	12	12

Use post-card service for special information

Name and Description	Junior High School	Senior High School	Technical High and Full-Time Vocational Schools	Part-Time Vocational School
Hammers				
Claw, 12 oz.....	25	25	25	25
Machinists', ball-peen.....	0	3	6	3
Hickey, ½" and ¾", each.....	0	6	6	6
Lathe				
Engine, 10" or 12" swing, 6' or 8' long.....	1	1	1	1
Speed	0	1	1	1
Pliers				
Gas, 6½".....	6	6	6	6
Gas, 8".....	0	0	9	12
Side-cutting, 6".....	25	25	25	25
Punches, assorted, sets.....	0	3	3	3
Punch, for metal molding.....	0	1	1	1
Reamers				
Pipe burring, ¼" to 1".....	6	6	6	6
Pipe burring, ½" to 2".....	0	2	2	2
Rules				
48" zigzag.....	25	25	25	25
72" zigzag.....	0	0	6	6
Screw Drivers				
3".....	25	25	25	25
5".....	25	25	25	25
8".....	2	4	4	4
Shears, for cutting metal molding	0	1	1	1
Soldering Coppers, assorted...	12	12	12	12
Soldering Copper, electric....	1	1	1	1
Soldering-Copper Handles	12	12	12	12
Solder Dippers.....	3	3	6	6
Stocks and Dies, for pipe threads, ½" to 1".....	3	6	6	4
Vises				
Machinists', 4".....	10	10	10	10
Pipe	4	8	8	6
Wrenches				
Adjustable, 6".....	0	6	6	6
Adjustable, 8".....	0	3	3	3
Pipe, 10", 12", and 14", each.	2	6	4	3
Socket, combination, sets...	0	1	1	1

Electrical Shop Supplies

25 Students Per Class

Name and Description	Junior High School	Senior High School	Technical High and Full-Time Vocational Schools	Part-Time Vocational School
Armored Cable				
2-wire, No. 14, single-strip, ft.	1000	1000	1000	1000
3-wire, No. 14, single-strip, ft.	1000	1000	1000	1000
Box connectors	50	50	50	25
Attachment Plug	25	25	50	50
Battery Acid, 1.300 carboy....	1	1	1	1
Batteries, dry cells.....	50	100	100	100

See classified directory for sources of supply

Name and Description	Junior High School	Senior High School	Technical High and Full-Time Vocational Schools	Part-Time Vocational School
Battery-Sealing Compound, lb.	50	100	100	100
Bar Hangers	50	50	50	100
Box Cleats	50	50	50	100
Brads, $\frac{3}{4}$ ", No. 19, and $1\frac{1}{2}$ ", No. 16, lb. each.....	5	10	10	10
Brake Lining, $\frac{1}{4}$ "x 2" ft.....	25	50	50	25
Brushes, carbon, for motors and generators	As required			
Burglar Contacts				
Open-circuit	6	6	12	25
Closed-circuit	6	6	12	25
Bushings				
Loom, No. 1 and No. 2, each	50	50	50	50
"Jiffy" loom No. 2.....	50	50	50	50
Buzzers	100	100	100	50
Cleats, unglazed porcelain, 2-wire	1000	1000	1000	1000
Clips, test, with insulators, Universal, Nos. 22, 23, 24, and 25. Each.....	20	20	20	20
Commutator Cement, cans....	0	0	1	1
Conduit				
Bushings, $\frac{1}{2}$ ", $\frac{3}{4}$ ", and 1" each	50	50	50	50
Box connectors, for flexible.	25	25	25	25
Couplings, for flexible.....	50	50	50	50
Lock nuts, $\frac{1}{4}$ ", $\frac{3}{4}$ ", and 1" each	50	50	50	50
Rigid, $\frac{1}{2}$ ", $\frac{3}{4}$ ", and 1", ft. each	2000	2000	2000	2000
Condulet				
Fillings, $\frac{1}{2}$ ", LL, LR, and LB, each	12	12	24	12
Covers, $\frac{1}{2}$ ", blank.....	36	36	72	36
Door Openers, mortised.....	10	12	24	12
Emery Cloth, $1\frac{1}{2}$ " wide, rolls.	1	1	1	1
Fixtures, brass-chain, suspension	10	12	12	12
Fixture Studs	10	12	12	12
Fish Paper, .0125" thick, sq. yd.	25	25	100	100
Fuses				
Plug-type, renewable, 125-volt, 15 amp.....	50	50	50	50
Cartridge-type, renewable, 125-volt, 30 amp.....	50	50	100	100
Renewals for plug fuses....	100	200	200	200
Renewals for cartridge fuses	100	300	300	300
Ground Clamps, $\frac{3}{8}$ " to 1", assorted	25	25	25	100
Hickey Grips, $\frac{1}{2}$ " and $\frac{3}{4}$ ", each	3	3	6	6
Lamps				
Carbon, 220-volt, 60 watt...	50	100	100	100
Mazda, 10-watt, type B, 120-volt	50	50	50	50
Guards, for brass sockets...	25	25	25	25
Leather Nail Heads.....	1000	1000	1000	1000
Lugs, 25 and 50 amp.....	100	100	100	50
Lumber, 2"x 4"x 14', No. 1, white pine, dressed 4 sides, pc.	25	100	200	200
Molding				
Metal, ft.	200	200	500	500

Use post-card service for special information

Name and Description	Junior High School	Senior High School	Technical High and Full-Time Vocational Schools	Part-Time Vocational School
Metal, fittings—crosses, tees, internal elbows, junction boxes, switch bases, keyless receptacles, snap switches. Each	25	25	25	25
Wood, 2-wire, with capping, ft.	200	200	200	200
Wood, 3-wire, with capping, ft.	100	100	100	100
Nails, roofing, lb.....	100	100	100	100
Nuts, iron, 4-36, 6-32, 8-32, 10-24, 12-24, 10-32, 14-20, gross each	1	1	1	1
Outlet Boxes, 4" square, with one round blank cover, and one cover with bushed opening, each	50	50	50	50
Pipe Straps, galvanized, $\frac{3}{8}$ ", $\frac{1}{2}$ ", $\frac{3}{4}$ ", and 1". lb. each...	5	5	10	10
Push Buttons				
Return-call, 3-point.....	50	50	50	100
Single-piece	100	100	200	100
Receptacles				
Flush, duplex.....	20	20	20	20
Porcelain - cleat, 660 - watt, 250-volt	500	500	500	200
Concealed	50	50	50	50
Covers	50	50	50	50
Resistance Units, 125-ohm....	25	100	100	100
Rosettes, wood	20	20	20	20
Screws				
Anchors, 8/32, 10/24, 12/24, 14/20, each.....	100	100	100	100
Machine, round-head, $\frac{1}{4}$ ", 4-36; $\frac{1}{2}$ ", 6-32; $\frac{3}{4}$ ", 6-32; $\frac{3}{8}$ ", 8-32; $\frac{1}{2}$ ", 8-32; 1", 8-32; $\frac{3}{8}$ ", 10-32; $\frac{1}{2}$ ", 10-24; $\frac{3}{4}$ ", 10-24; $\frac{1}{2}$ ", 10-32; 1", 12-24; gross each size.....	1	1	1	1
Machine, brass, round-head, $\frac{1}{4}$ ", 4-36; $\frac{1}{2}$ ", 6-32; $\frac{3}{4}$ ", 6-32; $\frac{1}{2}$ ", 8-32; gross each size	1	1	1	1
Wood, flat-head bright, $\frac{3}{4}$ " No. 5, $\frac{1}{2}$ " No. 8, $\frac{3}{4}$ " No. 8, 1" No. 7, 1 $\frac{1}{2}$ " No. 8, 1 $\frac{1}{2}$ " No. 10, 2" No. 7, gross each size.....	1	5	5	5
Wood, round-head blued, 1" No. 7, 1 $\frac{1}{2}$ " No. 8, 1 $\frac{1}{2}$ " No. 10, 2" No. 7, gross each size	1	5	5	5
Sleeving, No. 1, white, No. 1, blue, and No. 1, red. Spools each	0	1	3	3
Sockets, brushed brass				
Pull-chain	25	25	25	50
Keyless	25	25	25	50
Key	25	25	25	50
Socket Caps, $\frac{1}{4}$ " brushed, $\frac{3}{8}$ " bushed, each	50	50	50	100
Porcelain keyless, with caps	25	25	25	25
Solder Wire, 50/50, size No. 10, lb.	50	100	100	50
Soldering Paste, 2-oz. cans, noncorrosive	25	25	25	15
Soldering Salts, 1-oz. cans, noncorrosive	5	5	5	5
Split Knobs, porcelain.....	1000	1000	1000	1000

See classified directory for sources of supply

Name and Description	Junior High School	Senior High School	Technical High and Full-Time Vocational Schools	Part-Time Vocational School
Switch				
Battery, 4-point.....	50	50	50	50
Bases, porcelain for 10-amp. switches,	100	100	100	100
Boxes, 2 $\frac{3}{4}$ " deep.....	50	50	50	50
Entrance, safety, 2-pole, 30-amp., with 2-branch lighting circuits	10	10	10	10
Entrance, safety, 3-pole, 30-amp., 250-volt.....	25	25	25	25
Flush, push-button, S.P., D.P., 3-way, 4-way, each....	50	50	50	50
Surface, S1.....	50	50	50	50
Surface, S3.....	50	50	100	100
Surface, S4.....	25	25	25	25
Knife, type A, D.P.S.T., D.P.D.T., S.P.S.T., and S.P.D.T., each	5	5	10	10
Surface, snap, electrolier....	6	6	12	12
Surface, snap, S.P.D.P., 3-way, 4-way, each.....	...	...	...	50
Tacks, double-pointed No. 10, lb.	50	50	50	50
Tape				
Friction, $\frac{1}{2}$ -lb. rolls.....	100	100	100	100
Rubber, $\frac{1}{2}$ -lb. rolls.....	50	50	50	50
Tubes				
Porcelain, $\frac{1}{8}$ "x 3"	100	100	100	100
Porcelain, $\frac{1}{8}$ "x 5"	100	100	100	100
Porcelain, $\frac{1}{8}$ "x 10"	50	50	50	50
Tubing				
Flexible nonmetallic, $\frac{1}{4}$ " ft.	50	100	100	500
Flexible nonmetallic, $\frac{3}{8}$ " ft.	50	100	100	100
Washers				
Iron, $\frac{1}{4}$ " and $\frac{3}{8}$ " lb. each..	1	1	1	1
Brass, $\frac{1}{4}$ " and $\frac{3}{8}$ " lb. each..	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$
Wire				
Annunciator No. 18 or No. 20, lb.....	500	1000	1000	500
Fixture, No. 18, single yellow, with marker, ft.....	500	500	500	500
Fixture, No. 18, single yellow, with marker, ft.....	500	500	500	500
Rubber covered, solid copper, No. 10, black, ft.....	1000	2000	5000	1000
No. 10, white, ft.....	1000	1000	2000	1000
No. 14, black, ft.....	5000	10000	10000	10000
No. 14, white, ft.....	5000	10000	10000	10000
Rubber covered, No. 16, brewery cord, ft.....	100	100	250	250
No. 18, lamp cord, green and yellow, ft.	1000	1000	1000	500
S.C.C. copper magnet, enameled, sizes, Nos. 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, lb., each	25	25	25	25

Electrical Shop

Motor and Testing Equipment

Name and Description	Junior High School	Senior High School	Technical High and Full-Time Vocational Schools	Part-Time Vocational School
Annunciators				
Automatic needle-drop	4	6	6	3
Gravity-drop	2	3	6	3
Manual needle-drop	2	3	6	3

Use post-card service for special information

Name and Description	Junior High School	Senior High School	Technical High and Full-Time Vocational Schools	Part-Time Vocational School
Armatures, burnt-out, for re- pairing	0	0	25	25
Battery Charger, commercial.	0	1	1	1
Circuit Breakers				
Air, single-pole, overload, 25-amp., 550-volt.....	0	2	2	2
Air, single-pole, underload, 15-amp., 550-volt.....	0	2	2	2
Controllers				
For multiple-speed motor...	0	1	1	1
For 1-h.p., 110-volt series motors	0	1	2	2
Generators				
Motor-generator set, 10-h.p., to supply 110-volt.....	0	1	1	1
d.c., for testing purposes, battery charging, etc.....	0	1	1	1
Generator, 6-volt d.c., cou- pled to an a.c. motor, for 6-volt circuit testing	1	1	1	1
Auto generators of different makes	1	2	2	2
Gravity Cells	12	3	3	3
Magnets, testing, 10,000-ohm..	1	2	2	2
Meters				
Ammeter, standard, 60-amp., a.c.	1	1	1	1
Ammeter, standard, 60-amp., d.c.	1	1	1	1
Ammeter, student, 60-amp., a.c.	0	6	6	6
Ammeter, student, 60-amp., d.c.	0	6	6	6
Voltmeter, standard, 0-10- volt, d.c.	0	0	1	1
Voltmeter, standard, 110- 220-volt, d.c.-a.c. ....	...	1	1	1
Voltmeter, standard, 125- volt, a.c.....	1	1	6	3
Voltmeter, standard, 125- volt, d.c.....	1	1	6	3
Voltmeter, student, 110-volt, d.c.	1	3	6	6
Voltmeter, student, 110-volt, a.c.	1	3	6	6
Wattmeter, standard, 110- 220-volt, 30-60-amp., d.c.- a.c.	0	1	1	1
Wattmeter, student, 110-220- volt, 30-amp., a.c.-d.c.....	4	6	6	4
Watt-hour Meter, 125-volt, 5 amp., a.c., single-phase, various makes	1	2	3	3
Motors				
Auto starter, different makes	1	2	2	2
Burnt-out, fractional h.p., 110-volt, 60 cycle, for re- pairing	0	0	25	25
Compound, 1 h.p., 110-volt, d.c.	0	2	4	4
Multiple-speed, 1 h.p., 3- phase, 220-volt.....	0	0	1	1
Series, 1 h.p., 110-volt, d.c...	0	2	2	2
Shunt, 1-h.p., 110-volt, d.c...	0	2	2	4
Split-phase and repulsive, a. c., 110-volt, single-phase, assorted	0	0	2	6
Split-phase induction motors, fractional h.p., 110-volt, 60- cycle, different makes.....	0	6	6	6
3-phase, 1 h.p., a.c., 220-volt, various makes	0	4	6	6
3-phase, 2 h.p., 220-volt, a.c., various makes	0	6	8	6
Universal, fractional h.p., 110-volt, different makes..	0	2	2	2

See classified directory for sources of supply

Name and Description	Junior High School	Senior High School	Technical High and Full-Time Vocational Schools	Part-Time Vocational School
Universal, variable-speed, ½ h.p.	1	1	1	1
Platform Scale, 100-lb. capacity	0	0	1	1
Rectifiers, Tungars, for charging from 1 to 12, 6- and 12-volt batteries	1	1	1	1
Relays, Dixie.....	4	6	6	6
Resistance Boards, for testing.	6	6	6	6
Rheostats				
Compression, 275-watt	0	3	6	3
Field, for shunt and compound motors	0	3	6	3
Rotary Converter, 5-kw. capacity, 3-phase, a.c., 110-volt d.c.	0	0	1	1
Speed Counters, 0-9999.....	3	6	12	6
Spring Balances, 0-30 lb.....	6	12	12	6
Starting Boxes				
For compound motors, various makes	0	2	4	4
For shunt-wound, 1 h.p., 110-volt motors. Overload release	0	2	2	2
For shunt-wound, 1 h.p., 110-volt motors. No voltage release	0	2	2	2
Starting devices of various makes and principles, for 1 h.p., 3-phase, 220-volt, a.c. motors	0	2	4	6
Storage batteries, 6-volt.....	2	2	2	2
Switchboard, as required.....	1	1	1	1
Telegraph Sets, including sounders, keys, and relays, each	4	12	12	12
Telephones				
Complete bridging, independent phones	4	6	12	12
Couch vestibule telephones..	4	6	12	4
Receivers, transmitters, induction coils, condensers, and bridging switch hooks, each	4	6	12	4
Transformers				
Bell-ringing, 6-8-14-volt.....	12	12	24	12
Single-phase, 110-220-volt, S.K.V.A.	0	3	6	6

Use post-card service for special information

General Electric Company

General Offices: Schenectady, N. Y.

Sales Offices: Address nearest Office

Akron, Ohio, 159 S. Main St.
Amarillo, Tex., 806 So. Grant St.
Atlanta, Ga., 187 Spring St., N.W.
Baltimore, Md., 39 W. Lexington St.
Binghamton, N. Y., 19 Chenango St.
Birmingham, Ala., 602 No. 18th St.
Bluefield, W. Va., 307 Federal St.
Boston, Mass., 84 State St.
Buffalo, N. Y., 39 E. Genesee St.
Butte, Mont., 20 W. Granite St.
Canton, Ohio, 700 Tuscarawas St., W.
Charleston, W. Va., 304 Capitol St.
Charlotte, N. C., 200 So. Tryon St.
Chattanooga, Tenn., 536 Market St.
Chicago, Ill., 230 So. Clark St.
Cincinnati, Ohio, 215 W. Third St.
Cleveland, Ohio, 925 Euclid Ave.
Columbus, Ohio, 17 So. High St.
Dallas, Tex., 1801 No. Lamar St.
Davenport, Iowa, 111 E. Third St.
Dayton, Ohio, 25 No. Main St.
Denver, Colo., 650 17th St.

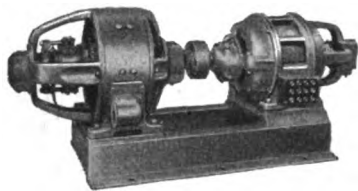
Des Moines, Ia., 418 W. Sixth Ave.
Detroit, Mich., 700 Antoinette St.
Duluth, Minn., 14 W. Superior St.
El Paso, Tex., 109 No. Oregon St.
Erie, Pa., 10 E. Twelfth St.
Fort Wayne, Ind., 1635 Broadway.
Fort Worth, Tex., 410 W. Seventh St.
Grand Rapids, Mich., 148 Monroe Ave.
Hartford, Conn., 18 Asylum St.
Houston, Tex., 1016 Walker Ave.
Indianapolis, Ind., 110 No. Illinois St.
Jackson, Mich., 212 Michigan Ave. W.
Jacksonville, Fla., 11 E. Forsyth St.
Kansas City, Mo., 1004 Baltimore Ave.
Knoxville, Tenn., 602 So. Gay St.
Little Rock, Ark., 223 W. Second St.
Los Angeles, Calif., 5201 Santa Fe Ave.
Louisville, Ky., 455 So. Fourth St.

Memphis, Tenn., 130 Madison Ave.
Miami, Fla., 25 Southeast 2nd Ave.
Milwaukee, Wis., 425 East Water St.
Minneapolis, Minn., 107 So. Fifth St.
Nashville, Tenn., 234 Third Ave., N.
Newark, N. J., 20 Washington Pl.
New Haven, Conn., 129 Church St.
New Orleans, La., 837 Gravier St.
New York, N. Y., 120 Broadway.
Niagara Falls, N. Y., 201 Falls St.
Oklahoma City, Okla., 15 No. Robinson St.
Omaha, Nebr., 409 So. 17th St.
Philadelphia, Pa., 1405 Locust St.
Phoenix, Ariz., 11 W. Jefferson St.
Pittsburgh, Pa., 535 Smithfield St.
Portland, Ore., 329 Alder St.
Providence, R. I., 76 Westminster St.
Richmond, Va., 700 E. Franklin St.
Roanoke, Va., 202 So. Jefferson St.
Rochester, N. Y., 89 East Ave.

St. Louis, Mo., 112 No. Fourth St.
Salt Lake City, Utah, 200 So. Main St.
San Antonio, Tex., 201 Villita St.
San Francisco, Calif., 235 Montgomery St.
Schenectady, N. Y., 1 River Road.
Seattle, Wash., 811 First Ave.
Spokane, Wash., 421 Riverside Ave.
Springfield, Ill., 504 E. Monroe St.
Springfield, Mass., 1387 Main St.
Syracuse, N. Y., 113 So. Salina St.
Tacoma, Wash., 1019 Pacific Ave.
Tampa, Fla., 112 Cass St.
Terre Haute, Ind., 701 Wabash Ave.
Toledo, Ohio, 520 Madison Ave.
Tulsa, Okla., 409 So. Boston Ave.
Utica, N. Y., 258 Genesee St.
Washington, D. C., 1405 G St., N. W.
Waterbury, Conn., 195 Grand St.
Worcester, Mass., 340 Main St.
Youngstown, Ohio, 16 Central Sq.

Motor-Generator Set

It is difficult to give adequate instruction and hold the interest of an electrical class with a laboratory equipment which consists chiefly of tools, benches, and wiring equipment. The average high school student longs for an opportunity to work with life sized electrical machines.



Motor-Generator with AHI and Direct-Current Machine, both Reversible in Operation

The type AHI motor generator set meets this need. The DC unit is standard, and the AHI AC machine conforms closely to commercial practice in physical and operating characteristics, but is designed to provide the flexibility demanded in educational work. It is available in two ratings: 12½ KVA or 9 KVA, 1800 R.P.M., 220 volt, 3 phase, 60 cycles. The stationary armature is equipped with a 12-terminal board and armature taps for phase changes. It has three interchangeable rotors for operation as an alternator, synchronous motor, constant or varying speed phase wound motor, frequency changer or squirrel-cage motor. Accessories include a plate-type field rheostat, auto-compensator, drum controller with grid resistor, field discharge resistor, base and pulley.

The flexibility of the AHI permits its use in a wide variety of experiments including alternator characteristics, synchronous motor characteristics, heat runs, checking vector calculations, 1, 2, 3, 6, and 12 phase work, frequency variations of 0 to 120 or more cycles per second, power factor, and many others. It also provides for a large group of experiments on the squirrel cage motor.

Ask your nearest sales office for complete information on G-E motor generator sets.

Portable Instruments

The importance of reliable meters for use in experimental work is generally acknowledged. General-Electric instruments are used universally and each type is recognized as being thoroughly reliable within the limits of accuracy for which that type is designed.



P-3 and DP-2

The Types P-3 (alternating current) and DP-2 (direct current) instruments are designed for laboratory and general testing purposes and comprise complete lines consisting, in the direct current instrument, of ammeters, voltmeters, milliammeters, millivoltmeters, thermal voltmeters and other meters. The alternating current (type P-3) instruments are supplied in ammeters, voltmeters, wattmeters, power factor and frequency meters.

The scales are equipped with mirror and knife edge pointers for accurate reading. All have zero adjusters. The type DP-2 instruments operate on the D'Arsonval principle. The type P-3 ammeters are of the iron vane type, all other type P-3 instruments operate on the Dynamometer principle.

The carrying cases are of mahogany. The dimensions of the type DP-2, approx. 8"x8"x4½". The type P-3 8½"x8½"x6".

AS-2 and DS-2

These small size instruments are intended for general testing work where it is not essential to have as high a degree of accuracy as is obtained in the larger types DP-2 and P-3 instruments. The type AS-2 (for alternating current) is supplied in double rated ammeters and wattmeters. The type DS-2 (for direct current) is supplied in combination ammeters-voltmeters having six ratings in the single instrument. The type AS-2 is an iron vane instrument. The type DS-2 operates on the D'Arsonval principle.

The cases are of moulded compound with hinged covers which completely enclose the scale glass, switch and binding posts. All instruments are supplied with zero adjusters.

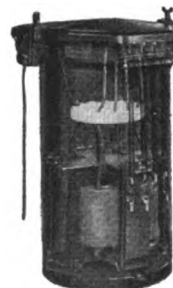
The dimensions of cases are 5½"x3½"x1½". The net weight is approximately 1 lb.



Transformers

A number of small distribution and power transformers are essential laboratory equipment. For this use transformers with standard taps for the duplication of all standard systems should be supplemented by transformers with 86.6 per cent and other special taps for making the hook-ups ordinarily met when changing systems from two-phase to three-phase, etc. There should also be taps for 5-10 per cent buck or boost for the balancing of lines.

The General Electric Company manufactures a complete line of transformers for every purpose and suitable equipment for any school laboratory can be furnished from stock or built to special specifications at reasonable cost.



Induction Voltage Regulators

In the laboratory, it is frequently necessary to make slight voltage adjustments in single phase or polyphase circuits. Such adjustments are difficult to maintain in alternating current circuits unless an induction regulator is available. This voltage regulation can be readily and accurately made or maintained with the G-E hand induction regulator. The standard regulator used for laboratory work is a miniature design rated at 2 KVA, 110/220 v., 60 cycle, 0-100 per cent buck or boost based on a one hour period of operation. Other sizes are also available. When employed for frequencies other than 60 cycles, their capacity varies approximately in the inverse ratio of the frequencies. These regulators weigh but 75 to 125 lbs., according to rating, thus making it easy to move them about. When provided with an indicating dial to indicate the rotor position it is always possible to return immediately to a given amount of buck or boost.



Motion Picture Films and Lecture Service

Instructors will find that consistent use of this service will solve the problem of illustrating the principles of construction and details of manufacture of many types of electrical machines. In addition to the motion picture films, many of which are of quite general interest, complete typewritten lectures accompanied by lantern slides or film rolls are available. These lectures in most instances are purely technical but many are arranged so as to be of general interest. Write to the nearest district office for bulletin and further information.

General Electric Company, Schenectady, N. Y.

Weston Electrical Instrument Corp.

588 Frelinghuysen Avenue, Newark, N. J.

Albany
Atlanta
Boston
Buffalo
Chicago

Cincinnati
Cleveland
Dallas
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Detroit

ENGINEERING AND SALES OFFICES
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The World's Scientific Standards

Wherever electrical tests are made, there is no single measurement which does not derive its authenticity from an original Weston discovery or invention. The use of Weston instruments in schools and scientific laboratories has become as thoroughly established as the art of measurement itself. It is a fixed principle that only "Westons" should be used in the study of electricity, just as Ohm's Law is a fundamental part of the student's educational

groundwork. Only the most exacting standards of craftsmanship and accuracy should be offered the student as examples of the precise work which makes for progress and success in the professional and scientific field. And that means "Westons"—the electrical measurement instrument standards of the world. Following are a few of the many hundreds of models shown in the Weston catalog—these being particularly recommended for school equipment.



Model 155

Model 155 Portable A. C. Ammeters and Voltmeters. For general alternating current testing. Movable iron type. Accuracy, within $\frac{1}{2}$ of one per cent. For use on commercial frequencies. Can also be used for direct current testing.



Model 540

Model 540 Portable D. C. Volt-Ammeters. Solid bakelite case, compact and durable. Provided with mirror scales, and quick range-changing device. Especially designed for student's use. A precision type instrument of pocket size, reasonably priced.

Miniature Portable A. C. Test Sets. Handy, compact, light-weight instruments enclosed in durable bakelite cases, furnished with leather carrying case. Model 539 Current Transformer; Model 528 One-Ampere Ammeter; Model 528 Voltmeter. Testing range from 0.2 to 200 amperes. Voltmeters can be supplied in various combinations of voltages. All instruments can be ordered singly, if preferred.



Model 45 Portable D. C. Ammeters and Voltmeters. Permanent magnet movable coil type instruments for general testing. Shielded from the effects of external magnetic fields. Accuracy, within $\frac{1}{2}$ of one per cent.



Model 45

Model 547 Radio Set Tester. A remarkably complete instrument, considered by radio dealers and professional servicemen as an indispensable aid in locating and correcting set troubles. For A. C. and D. C. Easy to operate, makes all the required tests. Complete with instruction book. Ideal for student's use.



Model 547

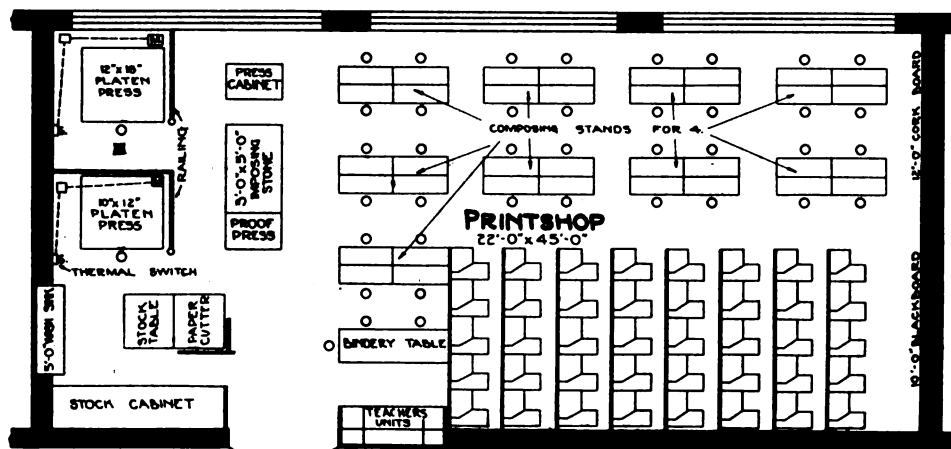
Other Weston Products

THE Weston line covers every field of electrical testing. Write for your copy of the 1930 Catalog containing descriptive information and prices with reference to hundreds of models and many thousand range combinations.

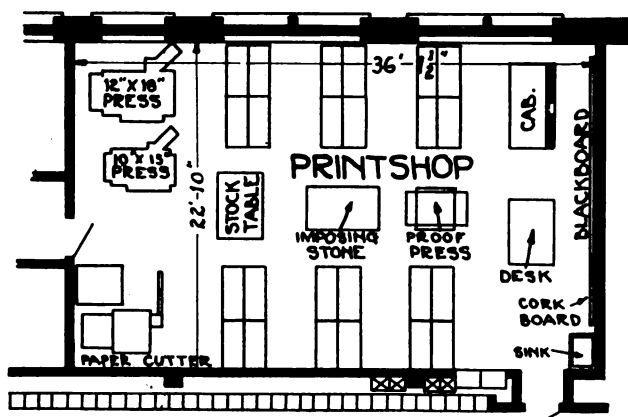
Weston Electrical Instrument Corp., 588 Frelinghuysen Ave., Newark, N. J.

Printshop Layout

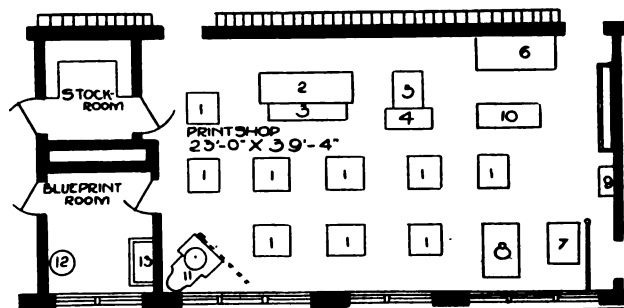
For outline of printing course see page 270
For equipment and supply lists, see page 235



JUNIOR HIGH SCHOOL, HAMTRAMCK, MICH.

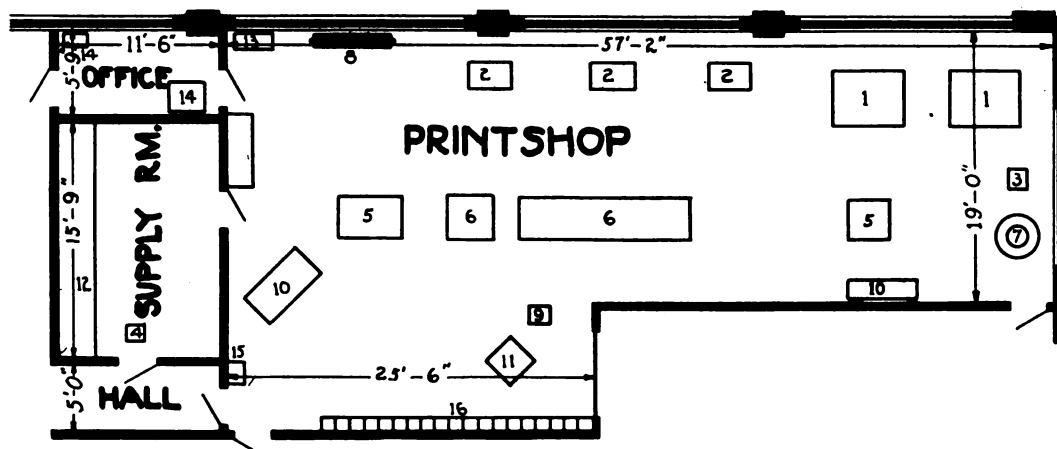


JUNIOR HIGH SCHOOL, CLEVELAND, OHIO



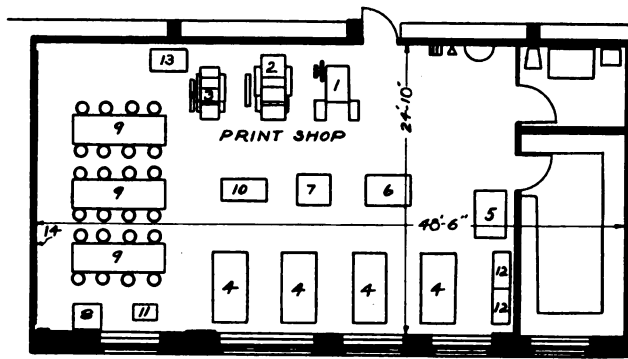
PRINTSHOP, NORMANDIN JUNIOR HIGH SCHOOL,
NEW BEDFORD, MASS.

- | | |
|-------------------|---------------------------|
| 1. Type Cabinet | 7. Platen Press |
| 2. Teacher's Desk | 8. Platen Press |
| 3. Galley Cabinet | 9. Ink and Roller Cabinet |
| 4. Proof Press | 10. Bookbinding Machine |
| 5. Imposing Table | 11. Paper Cutter |
| 6. Drying Rack | |



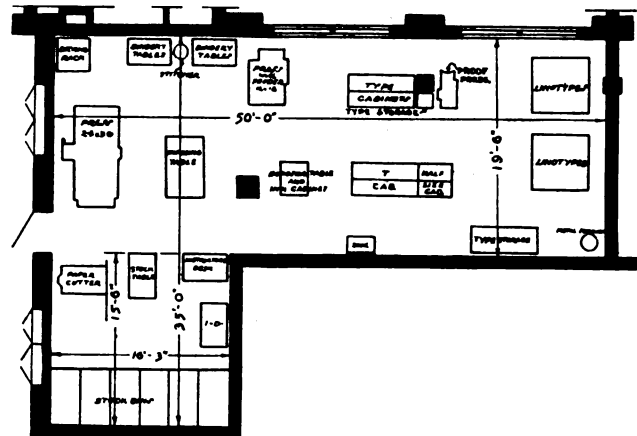
JOHN C. FREMONT HIGH SCHOOL, LOS ANGELES, CALIF.

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|----------------|--------------------|----------------------|--------------------|
| 1. Linotype | 5. Composing Stone | 9. Perforator | 13. Workbench |
| 2. Job Press | 6. Galley Rack | 10. Punching Machine | 14. Teacher's Desk |
| 3. Saw Trimmer | 7. Melting Pot | 11. Paper Cutter | 15. Washbowl |
| 4. Stitcher | 8. Case Rack | 12. Paper Rack | 16. Lockers |

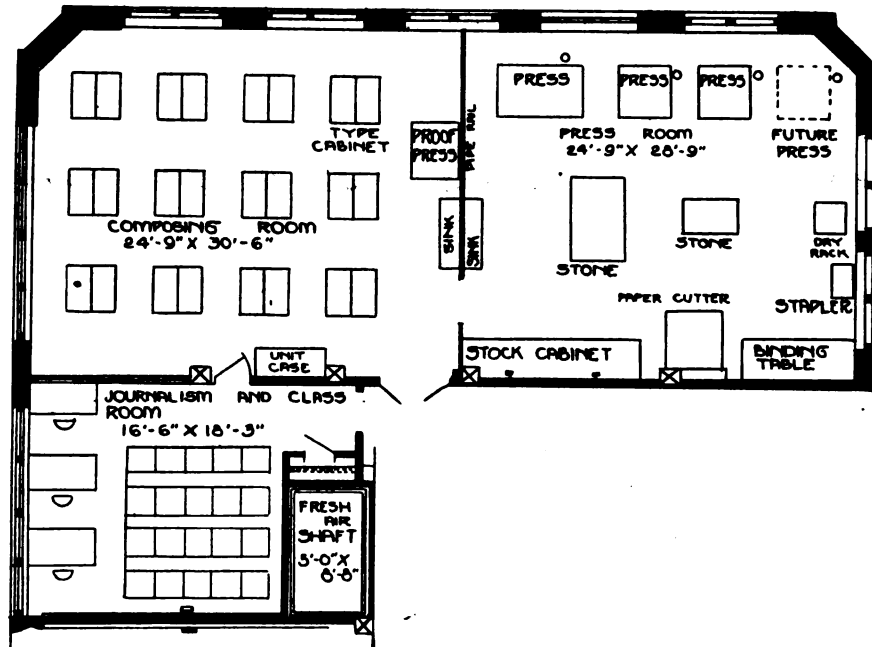


PRINTSHOP, WESTERN HILLS HIGH SCHOOL,
CINCINNATI, OHIO

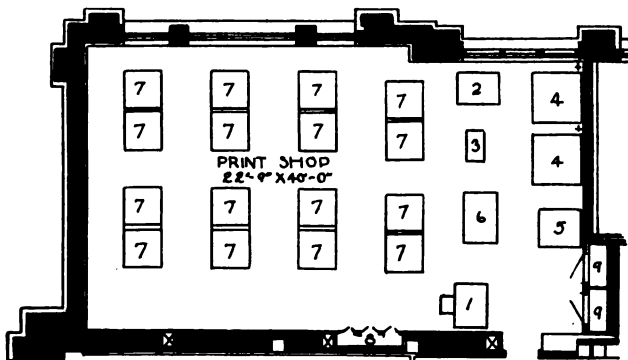
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|----------------------------|---------------------------|
| 1. 10x15 Platen Press | 8. Drying Rack |
| 2. 12x18 Platen Press | 9. 2'6"x8' Tables |
| 3. 8x12 Platen Press | 10. Proof Press and Stand |
| 4. Double-Tier Case Stands | 11. Wire Stapler |
| 5. 26" Lever Paper Cutter | 12. Galley Racks |
| 6. Imposing Table | 13. Chase Rack |
| 7. Pressroom Cabinet | 14. Blackboard |



PRINTSHOP, CHARLESTON SENIOR HIGH SCHOOL,
CHARLESTON, W. VA.

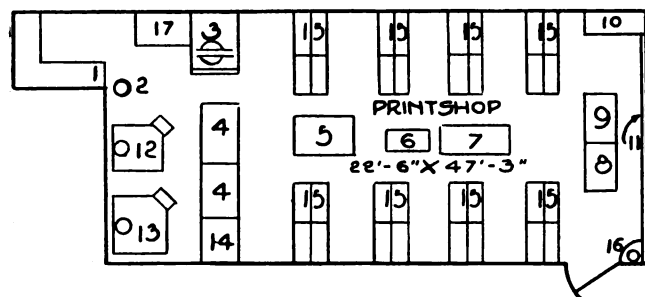


PRINTSHOP, PONTIAC HIGH SCHOOL, PONTIAC, MICH.



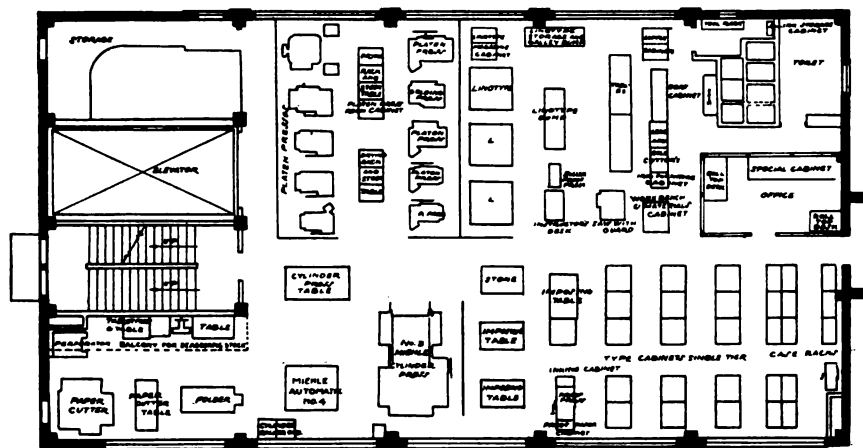
PRINTSHOP, FOCH INTERMEDIATE SCHOOL,
DETROIT, MICH.

- | | |
|--------------------|---------------------------|
| 1. Teacher's Desk | 6. Imposing Stand |
| 2. Teacher's Table | 7. Double Composing Stand |
| 3. Proof Press | 8. Cupboard |
| 4. Platen Press | 9. Stock Supply Cabinet |
| 5. Paper Cutter | |

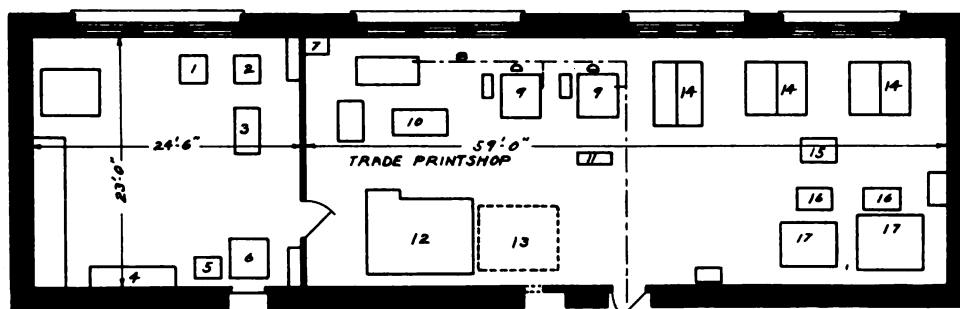


PRINTSHOP, ALEXANDER HAMILTON JUNIOR HIGH
SCHOOL, CLEVELAND, OHIO

- | | |
|----------------------|----------------------------|
| 1. Shelves 12" Apart | 10. Teacher's Cupboard |
| 2. Stapler | 11. Blackboard |
| 3. Paper Cutter | 12. 10"x15" Press |
| 4. Tables | 13. 12"x18" Press |
| 5. Stone | 14. Ink and Roller Cabinet |
| 6. Proof Press | 15. 32 Type Stands |
| 7. Type Cabinet | 16. Wash Bowl |
| 8. Desk | 17. Table |
| 9. Table | |

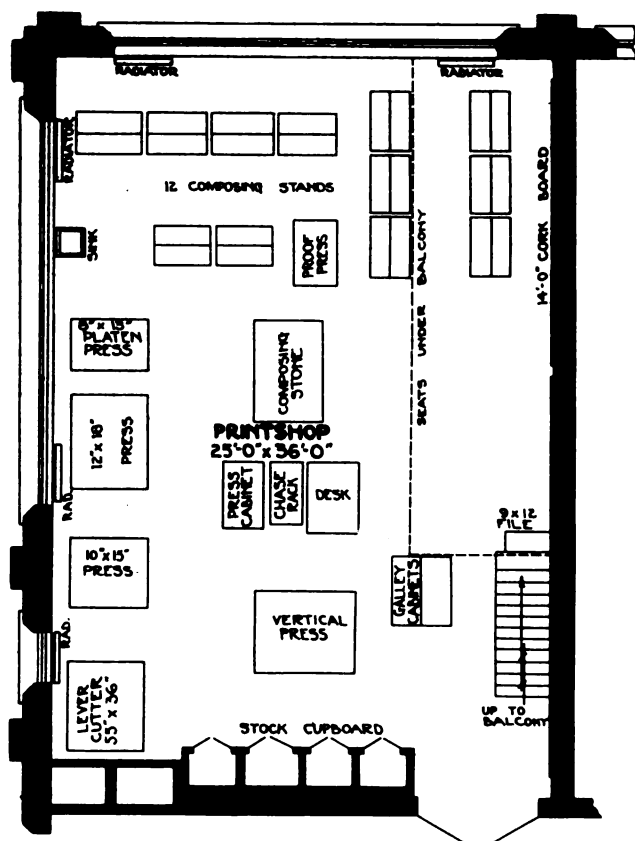


BOYS' TECHNICAL HIGH SCHOOL, MILWAUKEE, WIS.

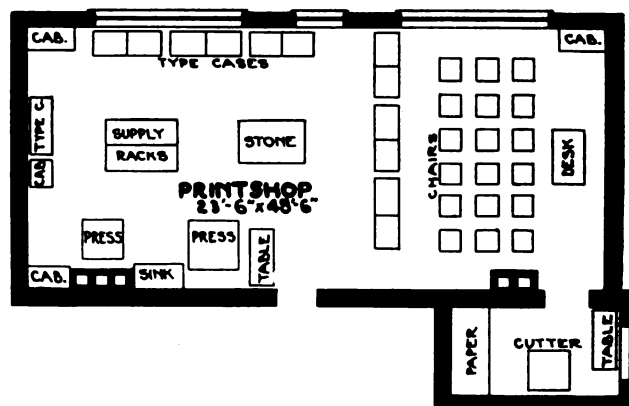


TRADE PRINTSHOP, EAST HIGH SCHOOL, ERIE, PA.

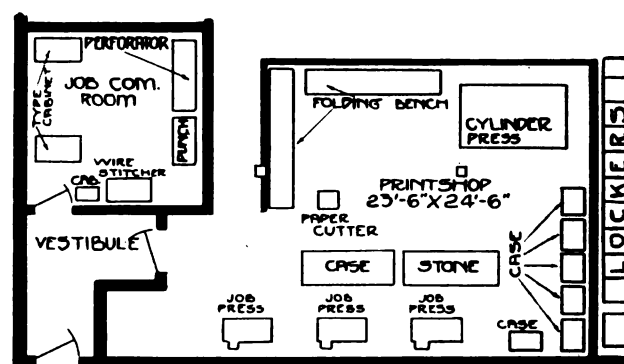
- | | | |
|---------------------------|----------------------|---------------------|
| 1. Punch | 7. Vertical File | 13. Folding Machine |
| 2. Perforator | 8. Gas Line | 14. Type Cases |
| 3. Desk | 9. Model Z Intertype | 15. Imposing Stone |
| 4. Stock and Glue Cabinet | 10. Imposing Stone | 16. Tables |
| 5. Sticker | 11. Proof Press | 17. Platen Press |
| 6. Buckram Cabinet | 12. Cylinder Press | |



HAMTRAMCK VOCATIONAL SCHOOL, HAMTRAMCK, MICH.



LA CROSSE VOCATIONAL SCHOOL, LA CROSSE, WIS.

PRINTSHOP, MANITOWOC VOCATIONAL SCHOOL,
MANITOWOC, WIS.

Printshop Equipment

15 Students per Class

Name and Description	Elementary School	Junior High School	Senior High School	Technical High and Full-Time Vocational Schools	Part-Time Vocational School
Brushes					
Bench	3	3	3	3	3
Benzine, No. 1, oval back...	1	1	2	3	3
Bulletin Board			1 or more as required		
Cabinets					
Galley, for double-column galleys. Wood or steel, 2 or more tiers.....	0	0	0	1	1
Ink and roller, to accommodate platen-press rollers, wood or steel.....	0	0	0	1	1
Job-case, complete with 25 full-size cases, lead and slug bank, etc.....	1	1	2	2	2
School-case, each to accommodate two California job cases, case slides, galley slide, and copy holder....	6	6	6	8	10
Wood or metal, for filing class records, instruction sheets, etc.....			1 or more as required		
Cans					
Benzine, pint size.....	2	2	2	2	2
Benzine, 5-gal. size.....	1	1	1	1	1
Kerosene, 1-gal. size.....	1	1	1	1	1
Cases					
Lead and Slug, regular size, to hold labor-saving fonts of leads and slugs.....	1	2	2	1	1
Rule, full-size, No. 2835, to accommodate 2 fonts of labor-saving brass rule...	0	1	1	1	1
Rule, quarter-size, for brass rules	2	0	0	..	..
Chairs, tablet-arm	15	15	15	15	15
Chases			As required		
Composing Rule			As required		
Composing Sticks					
6"x 2", adjustable.....	10	12	12	12	12
8"x 2", adjustable.....	2	2	2	4	4
12"x 2", adjustable.....	1	1	2	2	2
18"x 2", adjustable.....	0	0	0	1	1
Cutter					
Lead and rule.....	1	1	1	1	1
Paper, lever type, 19", with stand. Smaller sizes are not practical because the cutter should be able to handle 17"x 22" sheets....	1	0	0	0	0
Paper, lever type, 26" to 30".	0	1	0	0	0
Paper, lever type, 30" to 34" knives, divided back gauge, constructed for power attachment	0	0	1	1	1
Desk					
Teacher's, with drawer compartments	0	0	0	1	1

Use post-card service for special information

Name and Description	Elementary School	Junior High School	Senior High School	Technical High and Full-Time Vocational Schools	Part-Time Vocational School
Chair, to match desk.....	1	1	1	1	1
Drying Rack and Stock Table , (combination), for platen-press jobs, including 30 drying trays.....	1	1	1	1	1
Drying Trays , interlocking, for cylinder-press forms.....	0	0	0	1	1
Furniture , wood, labor-saving, with cabinet. Lengths of furniture, 10 to 60 picas; widths, 2 to 10 picas.....	1	1	1	1	1
Galleys					
Steel, 6"x10".....	12	12	12	12	12
Steel, 8¾"x13".....	2	2	2	2	4
Steel, double, 6¼"x23¼"....	0	0	0	12	50
Steel, 10"x16".....	1	2	2	2	2
Gauge Pins , spring-tongue....	12	12	24	24	24
Imposing Tables 36"x48", marble or steel surfaces, complete with galley slides, chase racks, letter slides, wood furniture and reglets..	0	1	1	2	2
Imposing Stone , 24"x36", marble surface, coffin or iron-surface imposing table.....	1	0	0	0	0
Imposing Stone Table , square legs	1	0	0	0	0
Knife					
Overlay	0	0	1	1	1
Ink, 6", round end.....	1	2	2	4	2
Ink, 8", round end.....	0	0	0	2	2
Leaders , 8-point, hyphen-line, lb.	10	10	20	20	20
Leader Boxes	1	2	2	2	2
Leads , 2-point, labor-saving font, lb.....	50	100	100	100	200
Mitering Machine	0	0	0	1	1
Metal Furnace , for recasting and refining machine type metal	0	0	0	1	1
Ornaments , assorted floral and decorative designs.....	0	0	12	12	12
Perforator , 24" or 26", foot-treadle	0	1	0	0	0
Perforator , 26" or 28", foot-treadle	0	0	1	1	1
Planer					
Mallets, hickory or fiber....	1	1	2	2	2
Proof, maple, with felt bottom	1	1	1	1	1
Type, maple, with leather top	1	1	1	2	2
Presses					
Cylinder, two-revolution, 2 or 4 rollers to accommodate regular book forms. Complete with variable-speed motor, cast rollers, etc.	0	0	0	1	1
Proof, 14"x24", iron stand..	1	0	0	0	0

See classified directory for sources of supply

Name and Description	Elementary School	Junior High School	Senior High School	Technical High and Full-Time Vocational Schools	Part-Time Vocational School
Proof, 12 $\frac{3}{8}$ "x18"; or 14"x18" bed.....	0	1	1	1	1
Platen, 7"x11" or 8"x12", with foot treadle, flywheel guard, brake, and set of cast rollers. (Motor and treadle combination if desired)	1	0	0	0	1
Platen, 10"x15", complete with foot treadle, variable-speed motor, flywheel guard, brake, and set of cast rollers, etc.....	0	1	1	1	1
Platen, 12"x18", complete with variable-speed motor, flywheel guard, brake, and set of cast rollers, etc.....	0	0	1	1	1
Punch, two-die, lever, with assorted punches	0	1	1	0	0
Foot-power, multiple, with assorted punches	0	0	0	1	1
Quoins					
Small-size	12	24	24	36	36
Keys, to fit quoins.....	1	2	2	2	2
Reglets, labor-saving, with cabinet. Nonpareil and pica widths, lengths from 10 to 60 picas.....	1	1	1	1	1
Saw Trimmer, pedestal type, point gauge.....	0	0	0	1	1
Slugs, 6-point, labor-saving font, lb.....	50	100	100	150	200
Spaces and Quads.....	One fifth the total weight of type listed, suited to type sizes.				
Staple Binder, pedestal type...	1	0	0	0	0
Stitcher and Stapler, power, capacity up to $\frac{3}{4}$ ". Flat and saddleback tables	0	1	1	1	1
Thin Spaces, assorted sizes, brass and copper, box.....	0	0	0	1	1
Type					
Body, lightface—					
8-point, lb.....	0	0	40	60	100
10-point, lb.....	120	140	120	200	240
Job, lightface—					
6-point, fonts.....	1	2	2	2	2
8-point, fonts.....	2	2	2	2	2
12-point, fonts.....	2	1	2	2	2
14-point, fonts.....	1	1	1	2	2
18-point, fonts.....	1	1	1	2	2
24-point, fonts.....	1	1	1	1	2
30-point, fonts.....	0	0	1	1	1
36-point, (caps only), fonts	0	0	0	1	1
48-point, (caps only), fonts	0	0	0	1	1
Job, lightface italic—					
8-point, fonts.....	0	1	1	2	2
10-point, fonts.....	1	1	1	2	2
12-point, fonts.....	1	1	1	1	2
14-point, fonts.....	0	0	0	1	1
18-point, fonts.....	0	0	0	1	1

Use post-card service for special information

Name and Description	Elementary School	Junior High School	Senior High School	Technical High and Full-Time Vocational Schools	Part-Time Vocational School
Job, boldface—					
6-point, fonts.....	0	0	0	0	2
8-point, fonts.....	1	2	2	2	2
10-point, fonts.....	1	2	2	2	2
12-point, fonts.....	1	2	2	2	2
14-point, fonts.....	1	1	1	2	2
18-point, fonts.....	1	1	1	2	2
24-point, fonts.....	1	1	1	2	2
30-point, fonts.....	0	0	1	1	1
36-point, fonts.....	1	1	1	1	1
48-point, (caps only), fonts	1	1	1	1	1
60-point, (caps only), fonts	1	0	1	1	1
72-point, (caps only), fonts	0	1	1	1	1
Job, boldface italic—					
8-point, fonts.....	0	0	1	2	2
10-point, fonts.....	0	0	1	2	2
12-point, fonts.....	0	0	1	2	2
14-point, fonts.....	0	0	0	1	2
18-point, fonts.....	0	0	1	1	2
24-point, fonts.....	0	0	0	1	2
Job, Copperplate Gothic—					
6-point, No. 22, fonts....	1	1	1	2	2
6-point, No. 23, fonts....	0	1	1	2	2
6-point, No. 24, fonts....	1	1	1	2	2
12-point, No. 25, fonts....	0	0	0	1	2
12-point, No. 26, fonts....	1	1	1	1	2
12-point, No. 27, fonts....	0	0	0	0	1
12-point, No. 28, fonts....	1	1	1	1	1
18-point, No. 30, fonts....	0	0	0	1	1
Job, Condensed Title Gothic					
24-point, fonts.....	0	0	0	1	1
36-point, fonts.....	0	0	0	1	1
48-point, fonts.....	0	0	0	1	1
60-point, fonts.....	0	0	0	1	1
72-point, fonts.....	0	0	0	1	1
Job, Text type—					
10-point, fonts.....	0	1	1	1	1
12-point, fonts.....	0	1	1	1	1
14-point, fonts.....	0	0	0	1	1
18-point, fonts.....	0	1	1	1	1
Job, Typewriter type—					
12-point, with justifiers, lb.	0	0	0	20	20
Wood, Condensed Gothic—					
8-line, fonts.....	0	0	1	1	1
12-line, fonts.....	0	0	1	1	1
18-line, fonts.....	0	0	0	1	1
Typesetting Machine, either Linotype or Intertype, 2 or 3 magazines and molds, 8- and 10-point mats.....	0	0	0	1	1
Tweezers	12	12	20	20	20

See classified directory for sources of supply

Printshop Supplies

15 Students per Class

Name and Description	Elementary School	Junior High School	Senior High School	Technical High and Full-Time Vocational Schools	Part-Time Vocational School
Benzine or Gasoline , for cleaning type or presses, gal.....	1	1	1	1	1
Bindery Tape , 2" wide, brown or black, rolls.....	1	1	1	1	1
Gold Bronze , pale, lb.....	0	0	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$
Gold Size , lb.....	0	0	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$
Ink					
Bond, black, for bond papers, lb.....	1	1	1	5	3
Job, black, for book papers, lb.	1	1	1	5	3
News, black, for print papers, lb.....	0	0	0	1	1
Colored, red, blue, yellow, green, etc., $\frac{1}{4}$ -lb. tube, each	1	1	1	2	4
Kerosene , for cleaning rollers, gal.	1	1	1	1	1
Pad Cement , for cold application, pints	1	1	1	1	1
Paste , bindery, pints.....	1	1	1	1	1
Paper					
Bond, medium grade, 17x22—20, white, reams.....	1	1	1	1	1
Bond, sulphite, 17x22—20, white, reams	1	1	1	1	1
Bond, sulphite, yellow, blue, pink, reams each.....	0	0	0	0	1
Book, enamel, 25x38—80, white, reams	1	1	1	1	1
Book, machine finish, 25x38—50, white, reams.....	1	1	1	1	1
Book, pamphlet, eggshell finish, 25x38—60, white, reams	0	0	0	0	1
Paper					
Cover stock, kind and color as selected, sheets.....	100	100	100	100	100
Index bristol, medium grade, 25 $\frac{1}{2}$ x30 $\frac{1}{2}$ —110, white, sheets	100	100	100	100	100
Index bristol, medium grade, 25 $\frac{1}{2}$ x30 $\frac{1}{2}$ —140, white, sheets	100	100	100	100	100
Ledger, medium grade, 17x28—30 $\frac{1}{2}$, white, reams....	0	0	0	0	1
Mill, bristol, 4-ply, white, sheets	100	100	100	100	100
Mill, bristol, 4-ply, red, sheets	100	100	100	100	100
Mill, bristol, 4-ply, yellow, sheets	100	100	100	100	100
Print, assorted colors, (Rainbow), 24x36—35, reams...	1	1	1	1	1
Proof, dry, cut to job size, reams	1	1	1	1	1

Use post-card service for special information

Name and Description	Elementary School	Junior High School	Senior High School	Technical High and Full-Time Vocational Schools	Part-Time Vocational School
Strawboard No. 40 or No. 50, bundles.....	1	1	1	1	1
Paper					
Tag board, manila, 24x36—140, sheets.....	100	100	100	100	100
Tympan, to fit presses, rolls.	1	1	1	1	1
Stitcher or Staple Wire					
¼", for stapling machine. Boxes containing one thousand each	5	5	5	5	5
No. 25 round wire for stitcher spools	1	1	1	1	1
Twine, cotton, for tying jobs, lb.	1	1	1	1	1
Bellows, hand, small size.....	1	1	1	1	1
Blackboard, permanent or portable			1 or more as required		
Bone Folders.....	2	2	4	4	4
Bookcase, for reference books, catalogs, etc			1 or more as required		
Borders, 6-point, decorative, fonts	2	2	3	3	3
Borders, 12-point, decorative, fonts	0	0	0	3	3
Brass Rule					
2-point, ¼-point side face, labor-saving, lb.....	3	10	10	10	15
2-point, 1-point side face, labor-saving, lb.....	3	10	10	10	15
Brayer, 6" or 8".....	1	1	1	1	1

See classified directory for sources of supply

American Type Founders Company

Education Department

300 Communipaw Avenue, Jersey City, N. J.

Distributed by Selling Houses located at:

Boston, Mass.
New York City
Philadelphia, Pa.
Richmond, Va.

Baltimore, Md.
Buffalo, N. Y.
Pittsburgh, Pa.
Cleveland, Ohio

Cincinnati, Ohio
Atlanta, Ga.
Chicago, Ill.
Detroit, Mich.

St. Louis, Mo.
Milwaukee, Wis.
Minneapolis, Minn.
Omaha, Nebr.

Kansas City, Mo.
Denver, Colo.
Portland, Ore.
San Francisco, Cal.

Seattle, Wash.
Spokane, Wash.
Dallas, Texas
Los Angeles, Cal.

School printshop equipment should not only conform to the best modern practise in commercial printshops, but should also be adapted to instructional conditions with due regard for efficient class management. The items here shown have been specially designed to meet school needs.

American School Type Cabinet

No. 9178 American School Type Cabinet in varnished antique finish is a handsome piece and harmonizes with the other wood furniture in a modern school. It accommodates



No. 9178—Front View

two pupils, and can be arranged in several positions with reference to other cabinets to suit floor space, lighting, etc. It has runs for 17 full size cabinet-front type cases, 2 pairs No. 2620 case brackets and slug rack above cases for lengths 10 to 26 picas by picas. One cabinet-front blank case No. 2706 is furnished with cabinet. Other cases are extra. A simple locking device to lock all type cases can be furnished at small extra cost.

No. 9179 American School Type Cabinet (No. 866 in steel) with adjustable top solves the problem of adapting the type case to the height of the student. Upon the body of the popular No. 9178 cabinet, from which the legs are omitted, is a working-bank top which can be raised or lowered at the will of the teacher. Under the working-bank top is a drawer with sloping bottom which serves as a convenient galley bank at the same height as the type case.

No. 9179-T Adjustable Top can easily be mounted on any flat-top type cabinet. It requires only boring seven holes and bolting two brackets in place. The mechanism is attached underneath the flat top, leaving the cabinet top clear and free of any projections. This top will give a more tidy appearance to the school printshop than can be secured with case brackets.



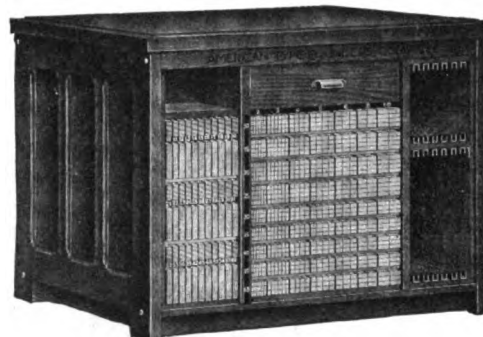
No. 9179—Front View

over the working top, also a locking device to lock all cases, may be provided as extras.

No. 870 American School Type Cabinet (in steel) is designed to suit the school where quality is desired but floor space is limited. The two single-tier cabinets in reversed position, surmounted by a working bank top provide accommodation for four pupils at a time in type setting. On each side of the cabinet is a rack for the standard Cut-Cost fonts of leads and slugs, also a galley dump. Each tier contains 21 California Job Cases and one blank case, all cases with steel fronts.

Lights over cases and

American School Imposing Tables

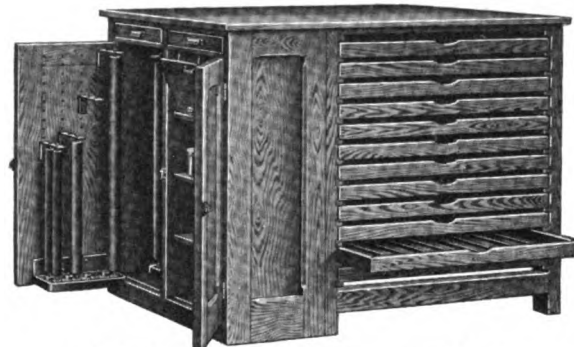


No. 3982—Reglet and Furniture Side

No. 3982 American School Imposing Table, includes units for No. 3720 font Reglet and No. 3744 font Furniture, Chase Rack Units Nos. 3891 and 3897 and Job Galley Unit No. 3856. Takes marble surface 32x48 inches in coffin, or iron surface 35x51 inches without coffin.

No. 3977 American School Imposing Table, includes units for No. 3744 font Furniture and No. 3730 font Reglet, Chase Rack Unit No. 3891 and Job Galley Unit No. 3854. Takes marble surface 28x36 inches in coffin, or iron surface 31x39 inches without coffin. Reglet font, furniture font and imposing surface are to be ordered separately.

American School Pressroom Cabinet



No. 9095—American School Pressroom Cabinet

No. 9095 American School Pressroom Cabinet, wood, varnished, containing twelve dryers, 30 x 30 x 1½ inches inside; compartment for sixteen rollers, any length up to 31 inches; two metal-lined compartments for rags; three compartments, 14½ inches wide by 12 inches deep by 7½ inches high, for ink; two shallow drawers, one for tools and one with removable black-enameled metal pan and plate-glass ink-mixing slab. Height, 40 in. Top, 33¾ x 50½ in.



No. 870 American School Type Cabinet

American Type Founders Company, 300 Communipaw Avenue, Jersey City, N. J.

The Challenge Machinery Co.

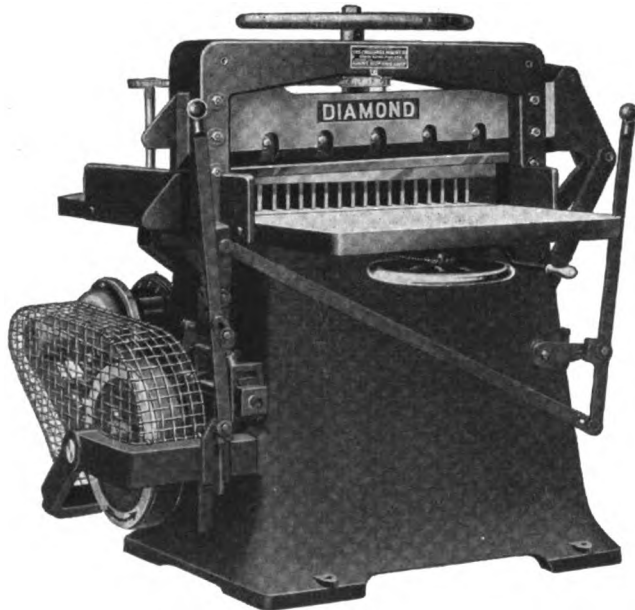
Main Offices and Factory, Grand Haven, Mich.

New York, 200 Hudson St.—WAREHOUSE BRANCHES—Chicago, 17-19 E. Austin Ave.

Manufacturers of

DIAMOND Power Cutters and LEE Two-Revolution Presses

The DIAMOND Power Cutter, equipped with the Challenge Frazee-Saur Safety Device, is made only by The Challenge Machinery Co. and especially suited for use in schools of printing.



Challenge-Diamond Power Cutter equipped with Challenge Frazee-Saur Safety Device.

The Challenge Frazee-Saur Safety Device absolutely prevents accidents to student operators. To keep the machine in operation, it is necessary for the operator to hold **both levers**. The instant he releases either hand, the machine stops. No chance for dangerous injuries—no chance for mangled, cut hands . . . they **must** be kept on both levers, removed from danger. The Challenge Frazee-Saur Safety Device is a Challenge Feature, designed for use in vocational schools.

Adequate additional safety features also are provided. The clamp extends below the knife to prevent cuts when working around the stock. There is ample clearance between the clamp wheel and the table to avoid scratches. A positive locking back-gauge eliminates cutting errors.

An ideal machine for the student. Simple and easy to operate. Rugged and durable—nothing to break or wear out.

Specifications

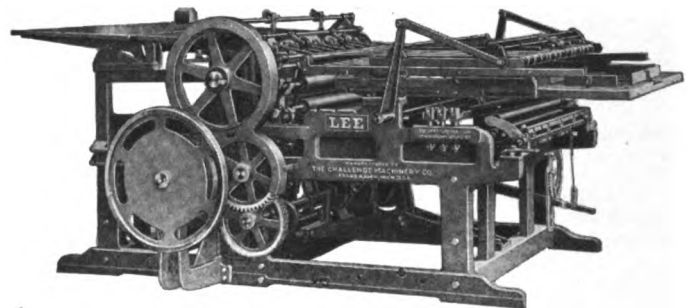
Made in two sizes: 30½" and 34½".* 2 H.P. Motor recommended. Regular equipment—two knives, four cutting sticks and a removable false clamp plate furnished with each cutter. Extra accessories—Motor, Motor Bracket, Controller, Belt, Belt Guard (a safety appliance required by law in most states), and two-hand Safety Locking Device—not included in price unless specified.

The CHALLENGE-LEE Two-Revolution Press is ideal for student and apprentice work, because it is easy to operate, reliable in action and all parts are readily accessible. A practical press that handles a wide range of work in one or more colors. Sturdily built, simple in design. Easy, smooth, quiet movement, free from jar and rumble, reduces wear, maintenance and power costs to a minimum.

Made in Fly and Carrier Delivery styles. The Carrier Delivery is made in two sizes: 24x36" and 25x38". The Fly Delivery comes in only the 24x36" size. A speed of 2500 impressions per hour with perfect register is attained with 24x36 Lee and 2000 per hour on the 25x38 Lee. Sizes given are the sheet sizes.

Always Perfect Register

Throughout the entire printing stroke of the Lee Press the bed is geared directly to the cylinder, with but two bearings between. No intermediate gear. The impression trip is simple and conveniently placed. Can be quickly and easily locked in non-printing position when desired, for the distribution of ink.



The Challenge-Lee Two-Revolution Press.
Two Styles, Two Sizes.

The responsibility of the manufacturers of Lee Presses is backed by more than 50 years' experience as producers of superior printing machinery. Lee Presses are as adaptable to use in vocational schools as they are to large printing plants. The same ease of handling and economy applies wherever Lee Presses are used.

Specifications

The 24x36" Lee requires 7' 8" x 4' 2" of floor space and the 25x38" size takes 8' 9" x 4' 8". The 24x36 requires a 1½ H.P. motor, and the 25x38 a 2 H.P. motor. Motor, Motor Bracket, Belt Guard and Gas Burner are "extras" and are not included in price unless specified.

The Challenge Machinery Co., Grand Haven, Mich.

The Chandler & Price Company

Cleveland, Ohio, U. S. A.

Manufacturers of

Platen Printing Presses and C & P Paper Cutters

C & P Platen Presses

The Gordon style of platen press, now manufactured only by Chandler & Price, is the standard job press commonly used in commercial printing plants and the most suitable press for schools of printing.



Chandler & Price Press equipped with flywheel gear and platen guards.

Sizes Suitable for Schools

Where only one press can be had, the 10x15 inch size is recommended. Where two presses can be installed, the 8x12 and 12x18 inch sizes represent the most desirable combination.

Brackets for Motors

When purchasing C & P Presses a motor bracket attached to the rear of the press is advisable. When attached to a regular C & P bracket the motor is raised from the floor, making the press and motor a compact, portable unit.

Sizes of Motors Required for C & P Presses

Horsepower of motors required for C & P presses is as follows:

8 x 12 Press.....	$\frac{1}{4}$	Horse Power
10 x 15 "	$\frac{1}{2}$	" "
12 x 18 "	$\frac{1}{2}$	" "

Suitable controlling equipment for motors on school printing presses, should permit of variable speeds. The minimum speed should be about 500 impressions per hour, and the maximum speed about 1800 impressions per hour.

Safety Guards

All presses should be fully guarded to protect pupils from injury. Complete equipment of safety devices is required by law in most states. Be sure to include the safety guards mentioned below. Combined gear and pinion guard is standard equipment. Other guards are extras.

Specifications

New Series C & P Platen Press (give size) with single disc, combined gear and pinion guard, crank shaft, three semi-steel chases, six roller trucks, six roller stocks, two wrenches and one brayer.

Extras for C & P Platen Press

Casting three rollers and brayer.
C & P Fibre Flywheel Guard.
C & P Platen Guard.
C & P Press Brake.
C & P Long Fountain.
Treadle Equipment.
Endless Leather Belt.
Motor Bracket with belt tightening adjustment including pulley.
Motor (give H. P. and voltage. For A. C. current give phase and cycle) variable speed with pedestal control, belt drive.

C & P Paper Cutters

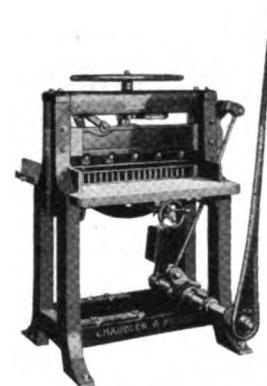
The essential features of a paper cutter are accuracy, ease of operation, safety, rigid construction, and durability. During the 20 years in which paper cutters have been made by the Chandler & Price Company, these vital considerations have never been overlooked.

C & P Lever Type

The sturdy construction of this cutter increases its life and insures the accuracy of its work. At the same time the weight is so evenly balanced that the cutter is remarkably easy to operate. The heavy side frames, top yoke, bottom girths and bed give this C & P lever cutter its strength. The extra long lever hung low on the machine gives maximum leverage.

Specifications for 26-inch Lever Cutter. C & P Lever Cutter, 26-inch, with brass scale set in table, counterbalanced lever, one knife, four cutting sticks.

Specifications for 30-inch Lever Cutter. C & P Lever Cutter, 30-inch, with $\frac{3}{4}$ " endless travelling band gauge, scale scribed in bed, two knives, four cutting sticks, frame drilled and tapped for later attachment of power fixtures.



Chandler & Price Lever Cutter, made in 26-in. and 30-in. sizes.

C & P Power Cutter

The same rigid construction which has made C & P Lever Cutters so popular has insured permanent success of the Power Cutter. Worm and gear drive, the most efficient and economical, provides a constant, even and smooth flow of power delivered at the knife. The knife mechanism is simple and always in absolute control of the operator. The positive clutch requires no adjustment, cannot get out of order, and its construction is such that it absolutely eliminates repeating.

34½" Craftsman Cutter

Equipped with adjustable $\frac{3}{4}$ " traveling overhead tape. Inscribed scale on front table. Three part back slide (adjustable forward and back). Adjustable back slide tongue. Adjustable binder gibs. Front and rear side plates (both sides). Right hand double motion control. Ball bearings in flywheel (only continuous moving part). Turnbuckle adjustment on knife bar. Flywheel-guard (extra). Solid base. Safety stop absolutely prevents cutter from repeating. Motor bracket under the bed with adjustable rails (extra).



Chandler & Price Power Cutter made in 30- and 34½-in. sizes.

The Chandler & Price Company, Cleveland, Ohio, U. S. A.

Cline Electric Manufacturing Co.

Main Office Conway Bldg., 111 W. Washington St., Chicago, Ill.

Western Office: First National Bank Bldg.
San Francisco, California

Eastern Office: Marbridge Bldg.
47 W. 34th St., New York City

Manufacturers of

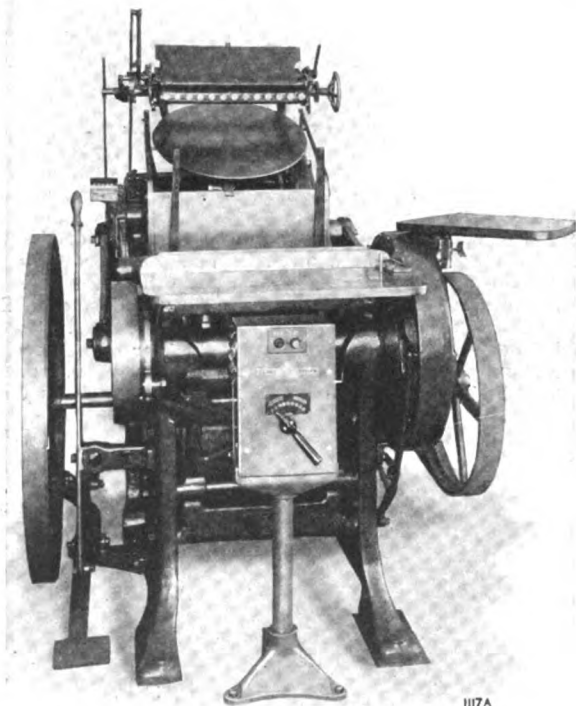
Motors and Control Equipment for Printing Machinery

The Cline Electric Mfg. Co. offers the advantage of more than 25 years of experience in designing electrical equipment and control systems for printing machinery. Their knowledge of the design and operating characteristics of these machines and their relation to other machinery in the plant layout, enables them to determine the correct type of motor and controller for such applications.

The service facilities of Cline-Westinghouse are excellent. The Westinghouse Company maintains sales offices in seventy-nine cities, warehouses in twenty-four cities, and service shops in twenty-two industrial centers in the United States alone, thus assuring prompt and efficient service.

Cline Job Press Control

The Cline Job Press Pedestal Type Control possesses certain advantages over other types of job press equipment which make it particularly desirable for use in the school print shop as well as in commercial plants. Chief among

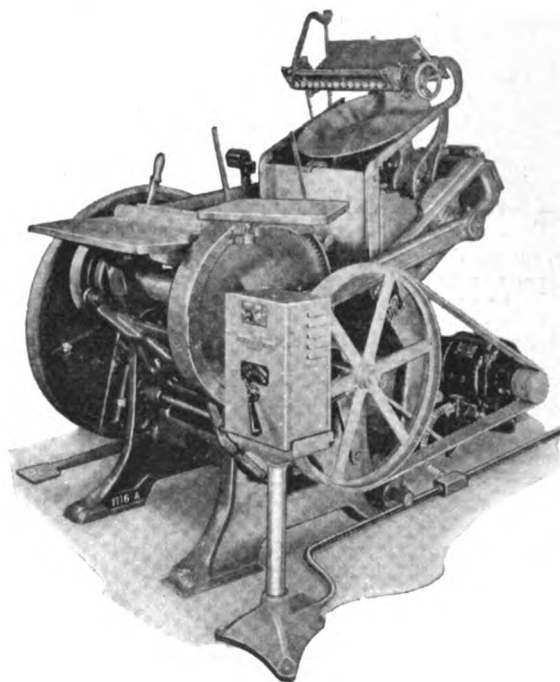


its advantages are its reliability, safety and durability. The Cline control may be located at any position convenient to the operator as there are no mechanical connections between motor and controller such as are required with other makes of job press equipment.



In construction, this equipment is typically Cline. While it is compact and as small as consistent with proper design and safety, it is sturdy, durable and, we believe, as free from possibility of trouble as any electrical equipment made. Its installation is simple and economical, all electrical connections are made through the pedestal base.

Mounted at the top of the fully enclosed steel controller cabinet are the push buttons for starting and stopping. Immediately below is the convenient controller handle by



means of which the printing speed is adjusted to any desired rate within the press manufacturer's recommendation. The unit is completely wired at the factory and requires but two external connections, one to the power source and one to the motor. Safety is an obvious feature of this press control; no live parts are exposed.

Motors and Control Equipment for

Newspaper Publishers
Stereotype Machinery
Book Binders
Electrotypers
Job Printers
Composing Machines
Magazine Publishers
Lithographers
Paper Box and Carton Mfrs.

Further Information

Will be furnished without obligation. Please state size and make of press, and current available (AC or DC).

Cline Electric Manufacturing Co., 111 W. Washington St., Chicago, Ill.

Miehle Printing Press & Manufacturing Co.

Fourteenth Street and South Damen Avenue, Chicago

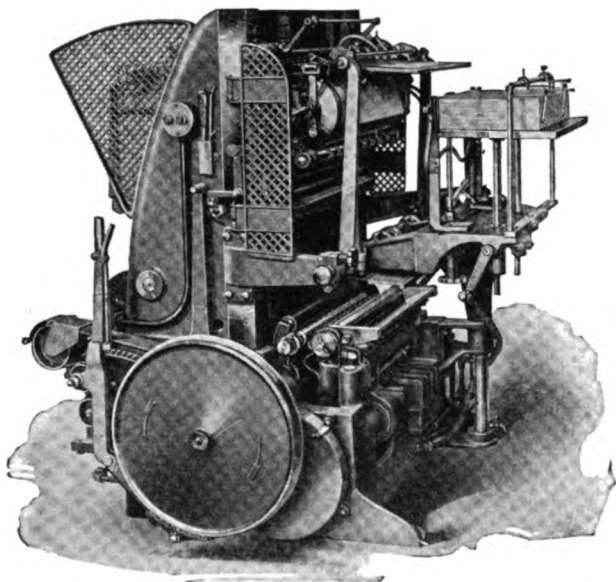
Manufacturers of

Printing Presses

Miehle presses are in universal use by leading printers all over the world. It naturally follows that Miehle presses are used by vocational schools everywhere in the

The Miehle

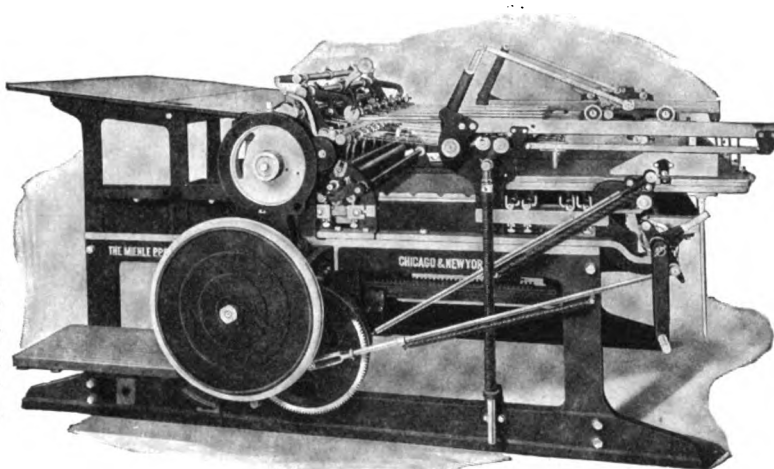
teaching of printing. Let us help you with your problems through our experienced staff of educators and salesmen. Send for a list of schools now using Miehle presses.



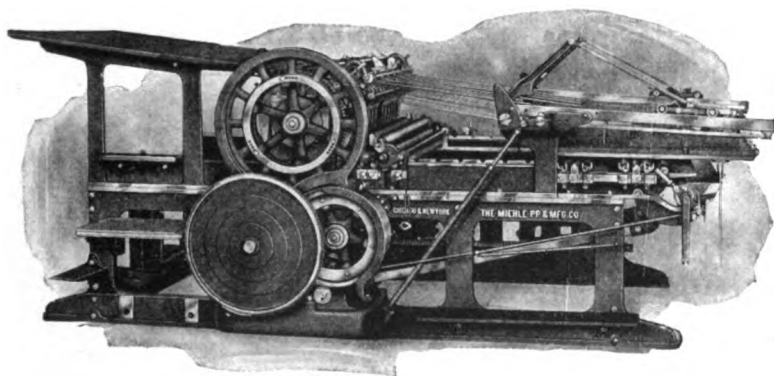
The Miehle Vertical

The Miehle Two-Revolution Two-Roller Pony Press

The Miehle two-revolution two-roller Pony press shown opposite is unusually well adapted for elementary cylinder press instruction, but is also used in some schools teaching advanced printing. It is simple in design, sturdily built and an ideal press for school instruction. It will print any size sheet up to $22\frac{1}{2}$ " x 34" and operates at a speed up to 2850 impressions per hour.



The Miehle Two-Revolution Two-Roller Pony Press



The Miehle Two-Revolution Four-Roller Press

The Miehle Vertical

The Miehle Vertical Automatic press possesses mechanical features common to both the Platen and Cylinder press. It is the logical step between the platen and flat-bed cylinder press for teaching the fundamentals of printing.

Specifications

Largest sheet which can be delivered $13\frac{1}{2}$ " x 20".

Smallest sheet, postal card, $3\frac{1}{4}$ " x $5\frac{1}{2}$ ".

Type matter locked in chase $12\frac{1}{4}$ " x 19".

Overall measurements:

Width—4 feet.

Length—5 feet.

Height—4 feet.

Speed range—2,000 to 3,600 per hour.

(As near fool-proof as it is possible to make it so.)

The Miehle Two-Revolution Four-Roller Press

Opposite is shown the standard Miehle two-revolution four-roller press used by commercial printers for producing the finest quality of halftone and process color printing. The press is suitable for all cylinder press instruction work, especially in those schools teaching the more advanced grades of printing. This type of press is made in a wide range of sizes.

Miehle Printing Press & Manufacturing Co., Fourteenth Street and South Damen Avenue, Chicago

Vandercook & Sons

900 No. Kilpatrick Ave., Chicago

Manufacturers of

Rigid Bed Proof Presses

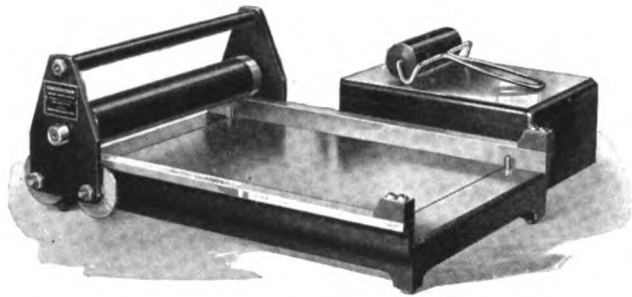
Vandercook & Sons are known as the originators of the modern proof press, and the introduction of the rigid bed proof press has made Vandercook the largest producer of this type of printing equipment.

Vandercook rigid bed proof presses range in size from the portable No. 0 to large machines which are virtually printing presses in themselves, thus meeting every proof press

requirement. An unusually high degree of workmanship characterizes these products. Accuracy is stressed, and as a result there is built into each machine the qualities of reliability and long life in addition to faultless performance. That such a policy has met with favor is evidenced by the extensive use of Vandercook rigid bed proof presses in the greatest printing establishments in the country and abroad.

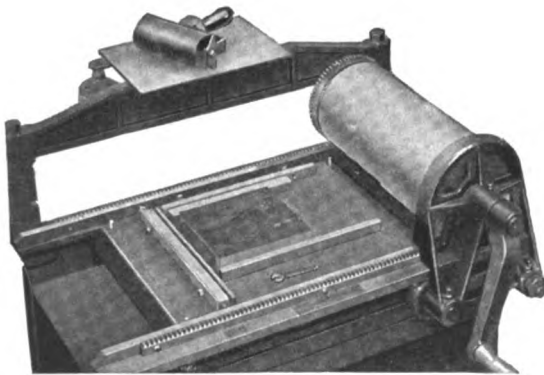
No. 0 Portable Proof Press

A new, low priced proof press incorporating the essential features of construction common to all Vandercook Proof Presses. All parts are sturdy and accurately made and machined, giving a degree of precision, reliability and



ease of operation hitherto obtainable only in the larger Vandercook Proof Press. Fully guaranteed. Perfect register is secured on color work by means of the Register Device described below. Prints uneven forms nicely without makeready. Takes forms up to 11 x 15". Ideal for the art room as well as the print shop, because it prints perfectly from linoleum blocks, wood cuts, or etchings or dry point plates. Complete with Ink Box, Inking Roller, Extra Inking Roller Core, Tube of Ink, Galley Thickness Bed Plate, Dust Cover and Register Device, \$47.00.

Vandercook Register Device



The Vandercook Register Device assures perfect register on color work. Permanent front and side guides are clamped in any position on the bed by means of set screws. The side guide is adjusted by means of set screws, that bear against the bearing rail of the Proof Press. Register adjustment on the other side of the form is obtained by

means of two set screws in the front guide bar which adjust an auxiliary steel bar. Furniture is used to obtain approximate register and the four set screws for close register. The use of a celluloid sheet greatly facilitates the process and permits exact adjustments to be made in short time. This device is applicable to any of the Vandercook Proof Presses.

Vandercook No. 1 Proof Press



An ideal machine for all hand inking work within its size; accurate, rigid and accessible. There is no drag on the form as the cylinder passes over. A single unsupported 10-point letter will remain standing during the impression and the single letter will show practically no more impression than a full form. **Standard Equipment** includes: Tympany, including Tindeck Blanket; Galley Thickness Bed Plate, 6-inch Handy Brayer Frame and two bare Cores; Ink Plate; Pressure Ink Well; Lock-up Pins; Tympan Wrench; Steel Blocks to secure press to floor; Steel Leveling Plates. **Specifications:** Printing surface, 14 x 18"; Bed Size, 14 x 19½"; Floor Space, 18 x 30"; Shipping weight, with cabinet, 380 lbs.

Vandercook No. 2 Proof Press

Here is an accurate, rigid proof press large enough to proof full length galleys of straight matter. It will handle all the proofing in the school print shop in addition to providing valuable instruction in make-ready and other problems. This proof press is so accurately and rigidly constructed that forms can actually be **tested** for faulty material or workmanship. Cuts may be underlaid, bad letters changed, rules joined, and, in fact, the methods of make-ready can be largely taught without tying up the regular press. **Standard Equipment** is the same as listed above for the Vandercook No. 1 Proof Press. **Specifications:** Printing Surface, 20 x 24"; Bed Size, 20 x 26"; Floor Space, 41 x 53" overall; Shipping weight, with Cabinet, 675 lbs.



Vandercook & Sons, 900 No. Kilpatrick Ave., Chicago

The Wanner Company

Established 1875

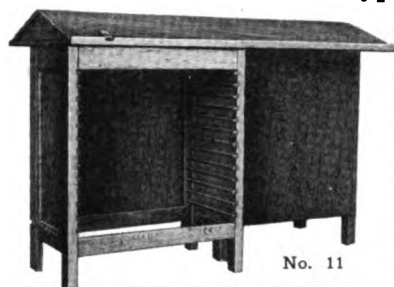
716 So. Dearborn St., Chicago, Ill.

New Equipment in Illinois, Michigan, Indiana, Ohio, Missouri,
Iowa, Minnesota, Wisconsin. Rebuilt Equipment to above
territory and States west of the Mississippi.

Complete Installations of Printing Machinery, Furniture, Supplies, Outfits, Binding and Folding Box Machinery

Equipping the school printshop is a problem we have dealt with for over 30 years. Efficient class management combined with instruction conditions should conform with modern commercial shop conditions. Various items of equipment have been specially constructed to conform with school shop administration. Other standard items are practical. A few items from our large complete stock are shown below. We represent Leading Manufacturers of Machinery, Furniture, Typefounder's Type and Supplies.

Wanner School Type Cabinet



Wanner School Type Cabinet
Space-Saver Unit for Four Students

The School Type Cabinets here illustrated are used in many school printing shops because they are composed of standard compact bodies having one tier of twelve cases facing each side at opposite ends. The large working top on Unit No. 11 provides the highly desirable feature of permitting

four students to work simultaneously without interference. Single tier cabinets and stands, with single or double side working tops, and composing room equipment of standard or special design in wood or steel furnished for any size school.

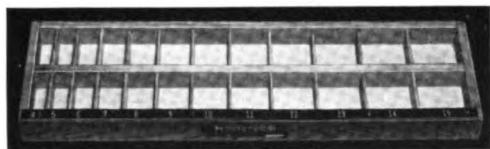
Wanner Cabinet Unit No. 11—39" high.

Wanner Cabinet Unit No. 12—43" high.

Note two styles lead and slug cases to work with Unit 12.



No. 12
Wanner School Type Cabinet

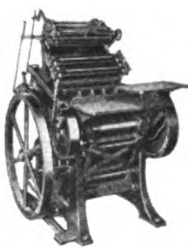


Double Depth Lead and Slug Case. Unit 112-A

Chandler & Price Job Presses. School Equipped

Chandler & Price Platen Job Press is the universally recognized standard in this style press. It is made in four practical sizes as follows: inside chase 8x12", 10x15", 12x18" and 14½x22". The size most desirable will be determined by size of classes and jobs to be produced. Every precaution for the personal safety of students has been provided for in attachments such as the flywheel guard, gear guard platen guard for finger protection when feeding, Wanner belt and pulley guard and Wanner impression lock guard.

Standard Equipment consists of Single Disc. Throw-off, Depressible Grippers, Three Semi-Steel Chases, Two Wrenches, Six Roller Stocks, Six Roller Trucks, Crank Shaft and Combined Gear and Pinion Guard.



C & P Platen Job Press

Lever and Power Paper Cutters

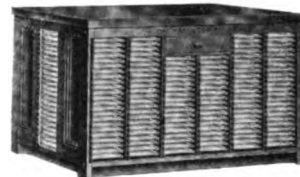
Paper Cutting Machines, hand lever operated, can be furnished in a range of sizes from 16" to 34½", and Power Cutters 30" and larger. The Advance, Diamond and Chandler & Price Cutters are of quality construction, recognized by school boards as a safe standard. These machines have been sold by us to school plants for years and are the safest and most popular to use. The size most desirable for your paper cutting purpose can be determined best by the size of presses used and size of jobs in classes. Write for specification sheets of power and lever cutters.



Paper Cutters

School Imposing Tables

Almost any arrangement of the holding frame for the imposing surface may be had. Illustrated are two arrangements. One, as shown, provides for reglet and furniture storage, and drawer for mallets, etc. Another, as shown, provides for ample galley storage, rack compartment for several chases each of 2 sizes and drawers. These holding frames



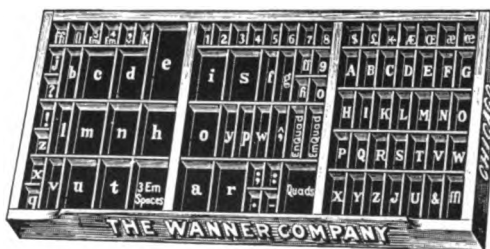
with marble or iron surfaces may be had in a range of sizes. The contents are standard units providing a number of arrangements, some interchangeable.

Type, Brass Rule, Supplies

Foundry Type, Brass Rule, Borders, Ornaments, Metal Rule, Wood Type, Leads and Slugs, Attachments and Supplies are sold by us and ready for prompt shipment.

We will be pleased to give you the most practical layout and a detailed estimate of a printing outfit upon receipt of information about the appropriation, number of students to be taught per class and per day, and the publications forms to be printed. We will gladly answer questions regarding care of machinery and mechanical problems. Don't hesitate to ask for such information as will help you.

School Case Layout Universally Used



The regular California Job Type Case for complete distribution of fonts of type is here illustrated. Hangers with illustration and list of proof readers' marks with other available instructors' information mailed to instructors in Printing Department on request. Give number of students in classes. Type and materials cases of many designs are available, and those standard assortments of cases in cabinet are recommended. A changed assortment can be made up to suit particular conditions.

The Wanner Company, 716 So. Dearborn St., Chicago, Ill.

Western States Envelope Co.

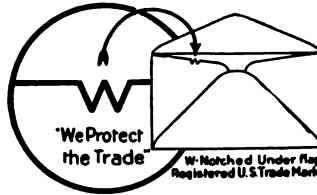
740-752 S. Pierce St., Milwaukee, Wis.

Long Distance Phone, Orchard 9310

Manufacturers of

Felt Brush Gummed Envelopes

Felt Brush Gummed Envelopes have introduced an entirely new era in envelope manufacture—eliminating Gumming and Printing troubles. Look



for the "W" notched under the flap of Western States Envelopes. This is the Company's Guarantee to you of the best there is in Envelope manufacture.

What We Are—What We Make What We Do

THE WESTERN STATES ENVELOPE COMPANY was organized May 1908, with one idea in mind, namely—that of operating an envelope factory that would do as printers would do if they were running it themselves.

We have done as much for you or even more than you would have done for yourselves had you been in our place; in fact, it can truthfully be said at this time that we are "YOUR ENVELOPE MANUFACTURER." Operating your Envelope Service Station.

Our first business is to plan and develop the envelope business in the interests of the printer and lithographer.

WE ARE EMPHATICALLY INDEPENDENT IN EVERY WAY.

WE MAKE all the regular sizes of commercial and official envelopes, from six to fourteen, including the special flaps of which we have over thirty nine different styles. See Trade Circular No. 2.

Also Look-In (Window) envelopes in 6¼, 6¾, 7, 7½, 8¾. (New Standard Check Size), 9, 9¾, 10, 11, and Tax Bill size. See new Trade Circular No. 3.

Postage Meter Look-In (Window) in sizes 6¼, 6¾, 7, 7½, 9, 10, and 11. Postage Saver envelopes (made with our large, square, loose Western States Flap) in 6¼, 9 and 10.

Also Postage Saver Look-in (Window) Envelopes in 6¾, 9 and 10.

Bankers Flap envelopes (without an equal for width of gum and efficiency of sticking qualities) in 9, 9¾, 10, 11, 12 and 14. We also carry in stock 9, 10, 9¾, and 11 sizes in the Look-In (Window) style. These are both Standard and Center Position Windows.

Don't fail to refer these inquiries to us.

Catalog envelopes in all sizes, especially 4 x 6½ to 11½ x 14½.

Coin Envelopes in 7 sizes in White and Kraft as well as Manila.

Metal Clasp Envelopes in 32 Jute Strength Stock, also 32 Glazed Kraft and 32 Aluminum Gray Kraft in all standard sizes.

Baronial Catalog envelopes in seven sizes.

Card Correspondence and Baronial envelopes, in fourteen sizes. All these sizes and styles are made from our regular grades of stock, or from stock which you furnish.

WE MAKE special envelopes of all sizes and kinds, from any paper. Put on metal eyelets in both large and small sizes.

Attach patch washers and make tag envelopes.

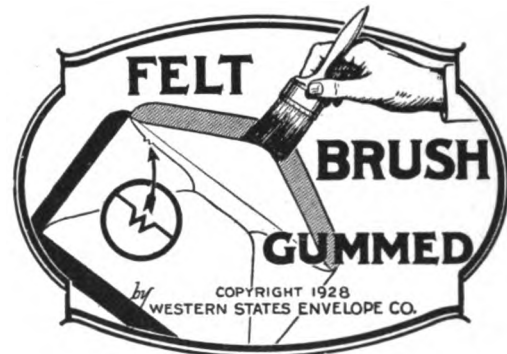
Put on double tongue fasteners, as well as string fasteners, on any envelope that we make or carry in stock, especially catalog envelopes.

WE DO mill printing of envelopes in the same satisfactory manner as you do in your own press room.

WE DO help you to print practically any envelope flat by furnishing the paper and layouts, or layouts for you to print on flat stock which you may have on hand, we making up the envelopes after printing. This service has been worked out by us to a science.

See Pages 32, 33, 34, 35 and 42 of Price List for other information.

Announcing Western States Felt Brush Gummed Envelopes



An Entirely New Type Envelope

Which is guaranteed to eliminate your gumming and envelope printing problems.

Eight points of superiority of Western States Felt Brush Gummed Envelopes.

1. Lumpy gum is impossible by this method.
2. Plenty of evenly distributed gum on flaps.
3. Envelopes lie practically flat—less dishing or wrinkling.
4. Gum is carried to the edges and ends of envelopes.
5. Larger, newly-designed flap enables you to print envelopes without the usual makeready.
6. Less space for storage—smaller boxes.
7. Stock is scored before being folded—insures smooth edges and square envelopes.
8. Uniform in size, fold and gumming—eliminating all envelope printing trouble due to variations.

These envelopes are in stock for immediate shipment in all regular better grades of stock, including bonds and kraits.



Guide Book through Envelope Land

Write for This Informative Envelope Book

This book contains the following bonafide Trade Information

(In addition to the above Stock Envelope Information)

Page 32 gives the number of envelopes out of almost any size of paper. This even includes Baronial Envelopes.

Pages 32-33-34 and 35 give prices for making envelopes from furnished stock, plain or printed.

Pages 44-45-46 and 47 give illustrations of different types and styles of envelopes.

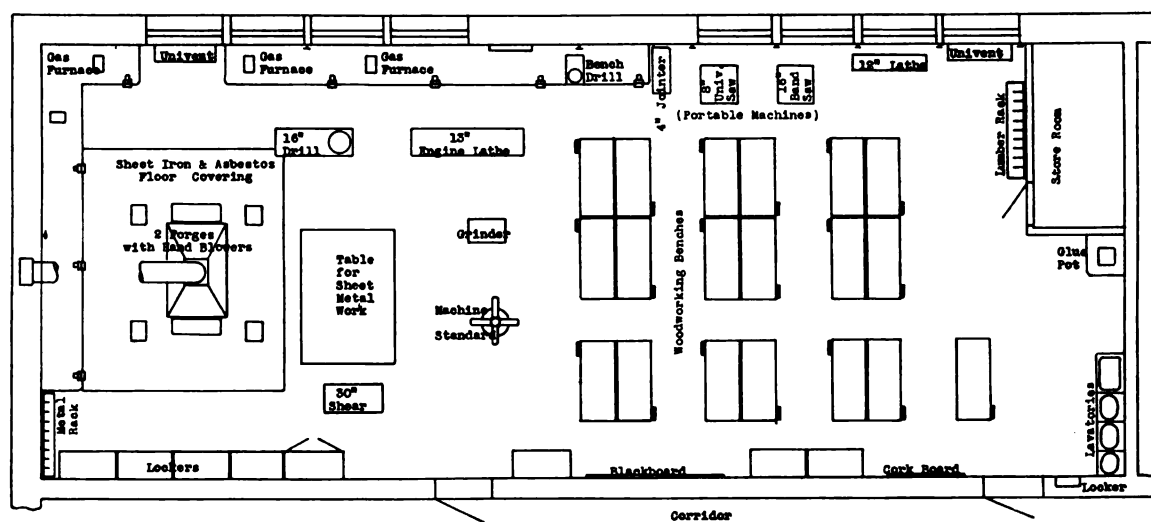
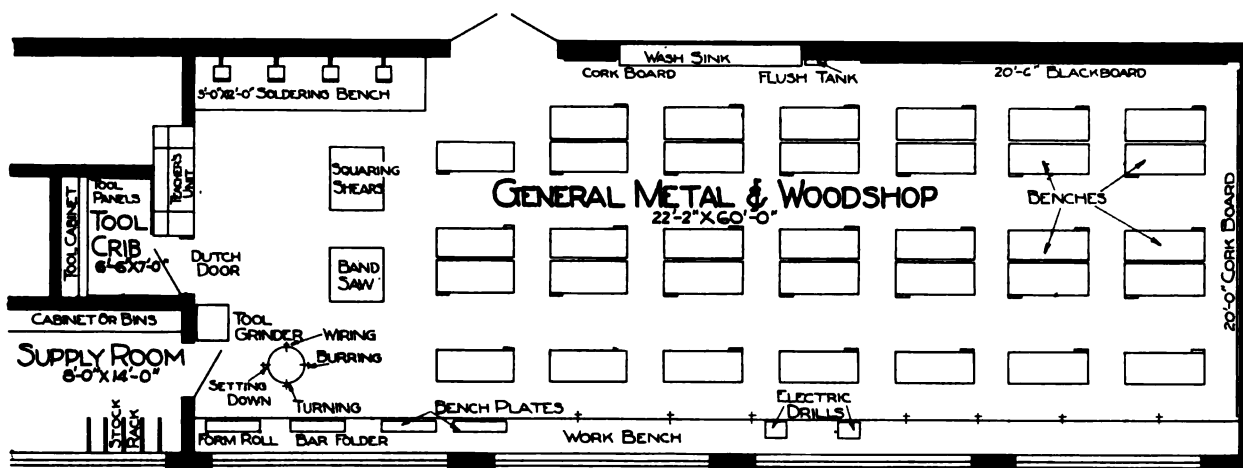
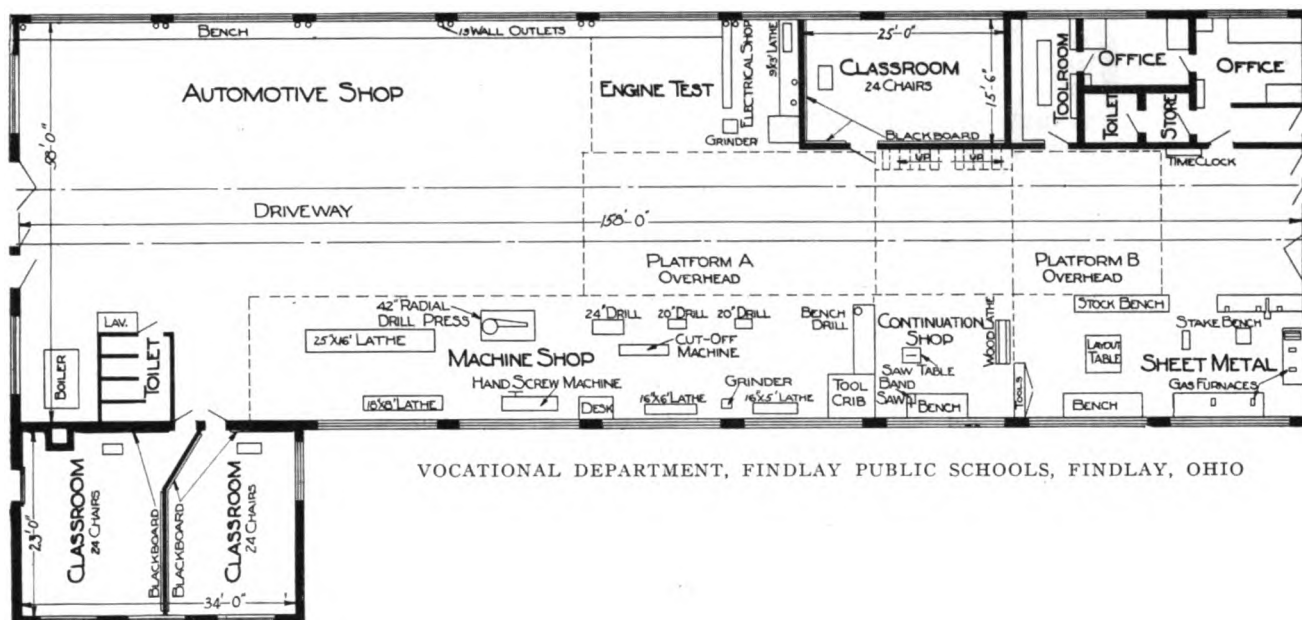
Pages 36 and 37 lists unusual envelope papers not regularly carried in stock.

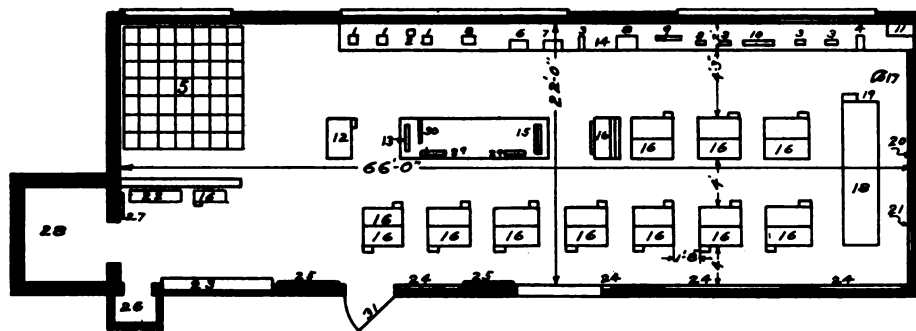
All the above is yours for the asking without any obligation.

Western States Envelope Co., 740-752 So. Pierce St., Milwaukee, Wis.

General-Shop and Home-Mechanics-Shop Layouts

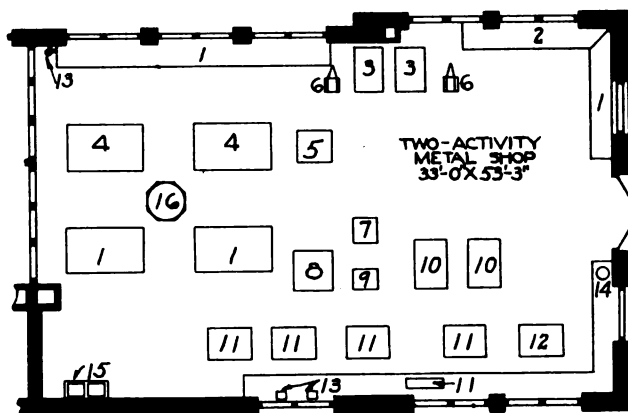
For outline of home-mechanics courses see page 273





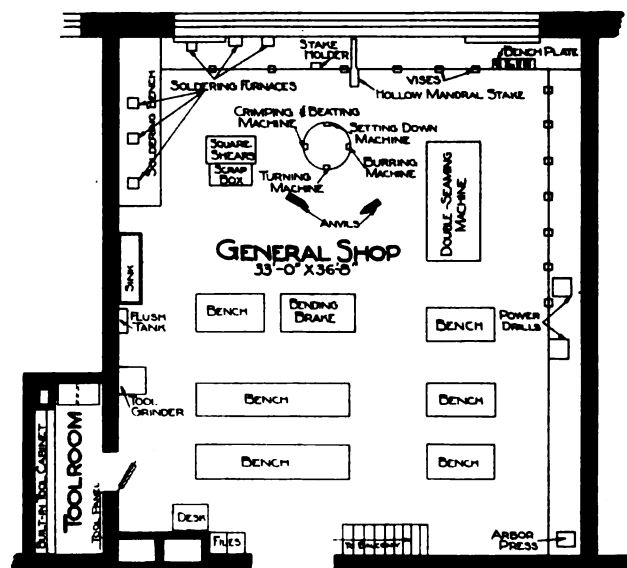
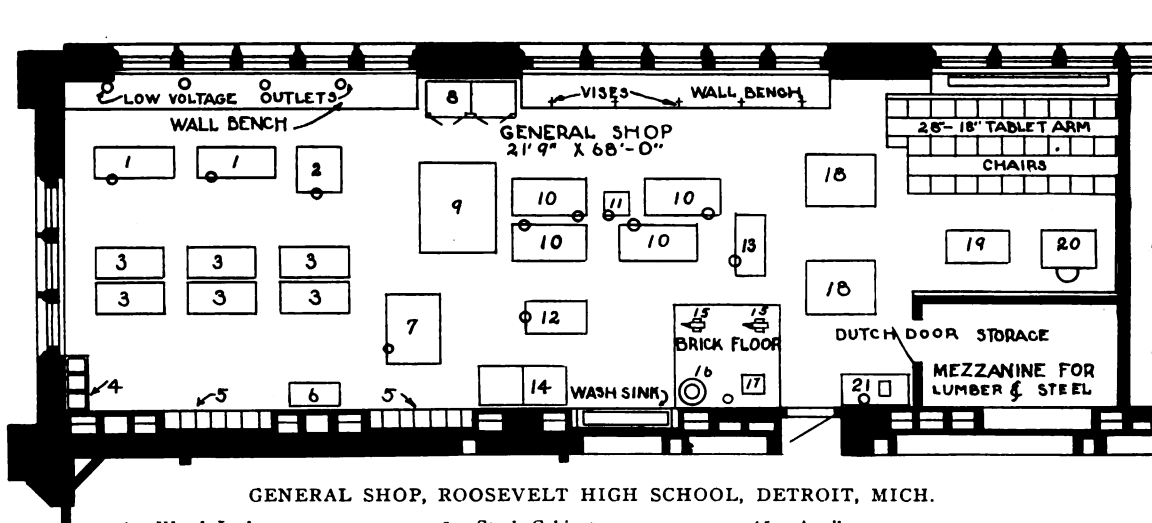
GENERAL SHOP, BURROUGHS INTERMEDIATE SCHOOL, DETROIT, MICH.

- | | | |
|--------------------|-------------------------|----------------------|
| 1. Furnaces | 12. Demonstration Bench | 23. Faucets and Sink |
| 2. Fan | 13. Bar Folder | 24. Lockers |
| 3. Vises | 14. Sheet-Metal Bench | 25. Bookcase |
| 4. Wiring Machine | 15. Forming Rolls | 26. Closet |
| 5. Student Seats | 16. Student Benches | 27. Bulletin Board |
| 6. Grinder | 17. Power Coping Saw | 28. Toolroom (Stock) |
| 7. Oilstone | 18. Electrical Bench | 29. Stake Plates |
| 8. Burring Machine | 19. Drill Press | 30. Reader |
| 9. Hand Former | 20. Blackboard | 31. Doorway |
| 10. Miter Saw | 21. Shelf | |
| 11. Paint Cabinet | 22. Instructor's Desk | |



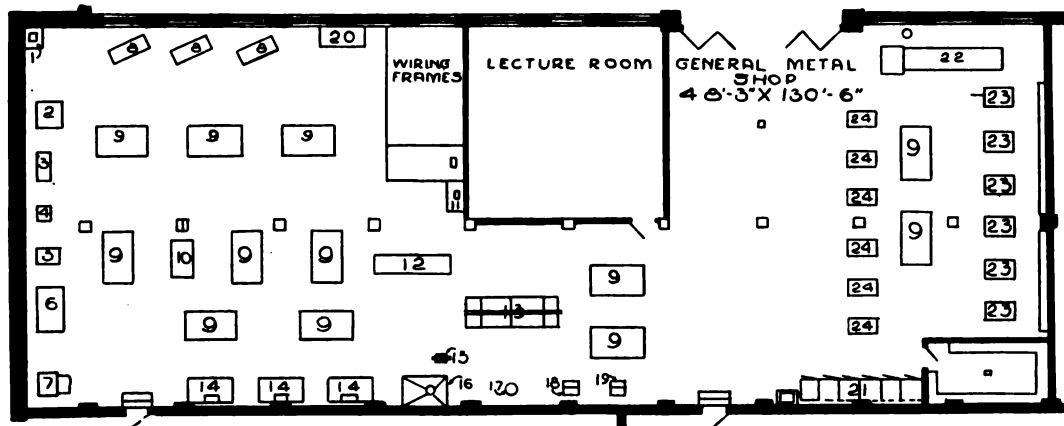
WEST JUNIOR HIGH SCHOOL, LANCASTER, PA.

- | | |
|------------------|-----------------|
| 1. Bench | 9. Grinder |
| 2. Foundry Bench | 10. Shaper |
| 3. Forges | 11. Lathe |
| 4. Layout Tables | 12. Milling |
| 5. Shears | 13. Gas Furnace |
| 6. Anvils | 14. Drill |
| 7. Drill | 15. Sink |
| 8. Brake | 16. Stake Bench |

HAMTRAMCK VOCATIONAL SCHOOL,
HAMTRAMCK, MICH.

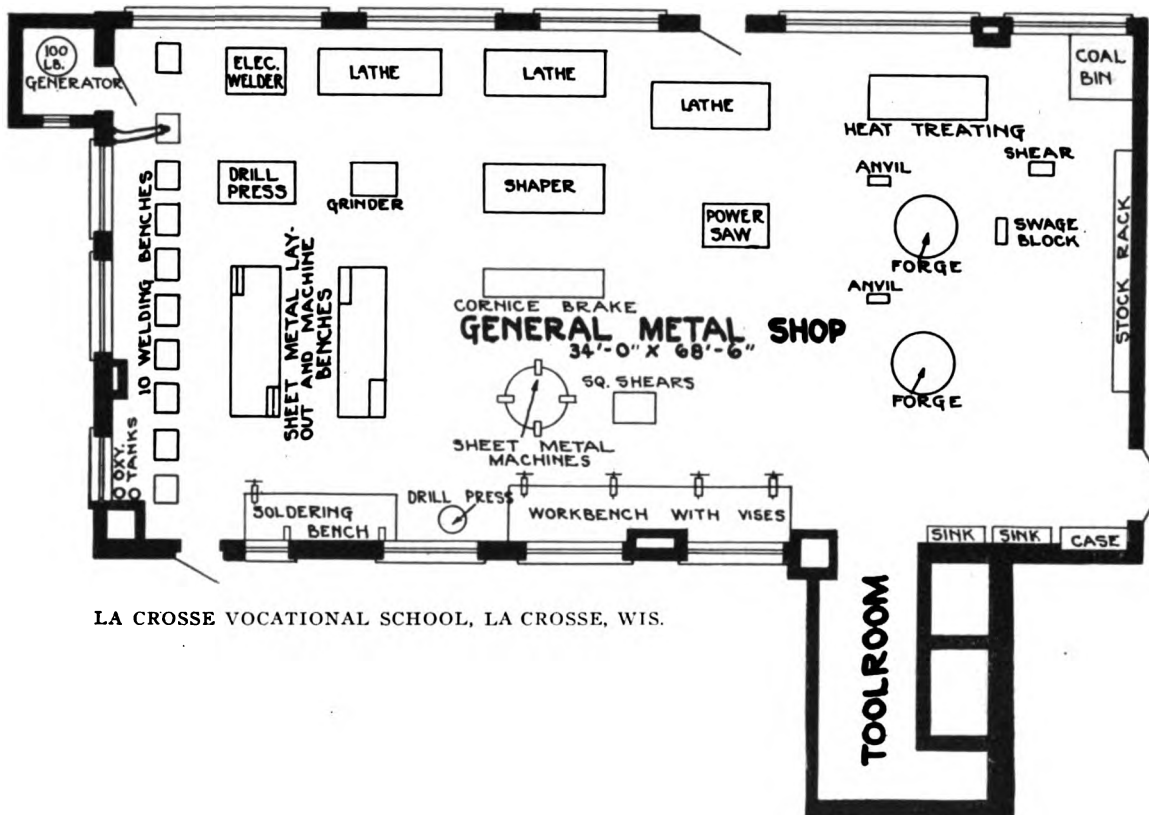
GENERAL SHOP, ROOSEVELT HIGH SCHOOL, DETROIT, MICH.

- | | | |
|--------------------------|--------------------|--------------------------------|
| 1. Wood Lathes | 8. Steel Cabinet | 15. Anvils |
| 2. Tool Grinder | 9. Milling Machine | 16. Soft-Metal Melting Furnace |
| 3. 2' 0" x 4' 6" Benches | 10. Engine Lathes | 17. Tool Dressing Forge |
| 4. Small Wood Stock Bins | 11. Tool Grinder | 18. Auto Motor Stand |
| 5. Lockers | 12. Drill Press | 19. Demonstration Bench |
| 6. Jointer | 13. Hack Saw | 20. Teacher's Desk |
| 7. Band Saw | 14. Molding Tub | 21. Soldering Furnace |

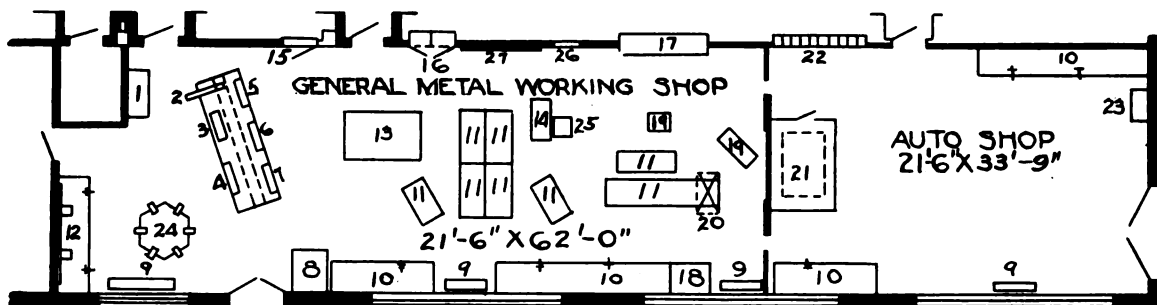


GENERAL METAL SHOP, JOHN ADAMS HIGH SCHOOL, CLEVELAND, OHIO

- | | | |
|------------------------|-------------------------------|----------------------------------------|
| 1. Arbor Press | 10. 3'x5' Bench | 19. 16" Grinder |
| 2. Shaper | 11. Electrical Supply Cabinet | 20. 6' Bench |
| 3. Hack Saw | 12. 2 1/4'x10' Bench | 21. Workbench with 2 1/2 x 2 1/2 Motor |
| 4. 14" Drill | 13. Molding Rack | Storage Below |
| 5. 17" Grinder | 14. Soldering Furnace | 22. Electrical Bench |
| 6. Brake | 15. Anvil | 23. Motor Stands |
| 7. 30" Squaring Shears | 16. Forge | 24. Transmission and Rear Axle |
| 8. Lathe | 17. Melting Pot | |
| 9. 4'x7' Bench | 18. 8" Grinder | |



LA CROSSE VOCATIONAL SCHOOL, LA CROSSE, WIS.



GENERAL METAL SHOP, ROYAL OAK HIGH SCHOOL, ROYAL OAK, MICH.

- | | | | |
|-----------------|---------------------|----------------------|------------------------|
| 1. Brake | 8. Squaring Shears | 15. Electric Cabinet | 22. Lockers |
| 2. Mandrel | 9. Heater | 16. Cabinet | 23. Heat Treating Unit |
| 3. Bench Plate | 10. Bench | 17. Lavatory | 24. Machine Bench |
| 4. Rotary Shear | 11. Lathe | 18. Desk | 25. Grinder |
| 5. Groover | 12. Soldering Bench | 19. Drill Press | 26. Keys |
| 6. Bar Folder | 13. Shaper | 20. Arbor Press | 27. Bulletin Board |
| 7. Slip Roll | 14. Power Saw | 21. Tool Crib | |

The Bruce Publishing Company

354-364 Milwaukee St., Milwaukee, Wisconsin

New York, N. Y., 342 Madison Ave.

Chicago, Ill., 66 E. South Water St.

Publishers of

Books for the School Shop



General

Reference books are as important in the school shop as in the academic classes. There are expressions used in the shop that puzzle and confuse the student and some teaching methods and equipment problems that the instructor may want to know about. These books will be very helpful:

Dictionary of Technical Terms, Crispin.....	\$1.25
Graphic Aids in Occupational Analysis, Bowman.....	3.75
Industrial Arts and Prevocational Education in Junior High Schools, Edgerton .....	.80
Supervision of the Special Subjects, Greene.....	1.75
Industrial Arts Magazine (One Year's Subscription).....	2.50
Bruce's 1930 School Shop Annual.....	2.00

Woodwork

Variety in woodworking is as necessary as it is desirable. It makes for alert, interested students, and it introduces a wide assortment of tools and processes. The following list of books includes texts filled with simple, easily constructed projects, and in the advanced group, problems sufficiently difficult for the most experienced artisan.

Elementary

Job Sheets in Practical Woodworking, by A. G. Brown, Instructor Woodwork, Stout Institute, Menomonie, Wisconsin, and F. E. Tustison, Head of Dept. of Home Mechanics, Stout Institute.

Job sheets presenting practical introductory course in hand tool woodwork. The essential principles and processes of hand tool woodwork are linked up with typical practical projects.

Loose Leaf, 31 jobs; 7¼x10¾". Price, 56c per set.

Job Sheets in Home Mechanics, I, by F. E. Tustison.

A group of thirty-nine (39) principal home jobs. Excellent material on Woodwork, Wood Finishing, General, Sheet Metal, Bench Metal, Plumbing, Electricity, and Concrete. Jobs printed on loose leaf sheets, can be inserted in standard binders.

Loose Leaf, 39 jobs; 7¼x10¾". Price, 64c per set.

Job Sheets in Home Mechanics, II, by F. E. Tustison.

Continuation of JOB SHEETS IN HOME MECHANICS, I. Contains additional material in Woodwork, General, Sheet Metal, Electricity, Bench Metal, and Plumbing.

Loose Leaf, 16 jobs; 7¼x10¾". Price, 36c per set.

Easy-to-Make Toys, by Charles A. Kunou.

Another fascinating toy book by Mr. Kunou. Splendid variety of coping saw toys with detailed drawings of animals, clowns, candlesticks, carts, autos, boats, etc.—sixty-five in all.

Board covers, 80 pages; 8½x11½". Price, \$1.44.

Toys Every Child Can Make, by Harry B. Wright, Buffalo, New York.

A book of patterns of novel toys with a complete circus for elementary classes in woodwork. Author presents a great variety of drawings, supplied with complete working directions. Excellent for both woodwork and paper construction.

Cloth, 64 pages; 9¼x12". Price, \$1.60.

Boy Bird House Architecture, by Leon H. Baxter, Director Manual Training, St. Johnsbury, Vt.

Twenty plates of every variety of bird houses to attract and hold birds. Illustrations very clear, instructions very graphic.

Cloth, 64 pages; 6x9". Price, \$1.00.

Permanent Bird Houses, by Gladstone Califf, Supervising Principal, Deerfield Grammar School, Deerfield, Illinois.

Splendid guide for bird house building. Contains numerous drawings of bird houses, supplemented with photographs of completed houses. Houses selected for practicability and permanence.

Cloth, 64 pages; 6x9". Price, \$1.00.

American School Toys, by Charles A. Kunou, Supervisor of Manual Training, Los Angeles, Calif.

A book of coping-saw toy patterns. The majority are full size. Design excellent. Colors simple, but effective.

Board, 72 pages; 8½x11½". Price, \$1.35.

Toy Craft by Leon H. Baxter, Director Manual Training, St. Johnsbury, Vermont.

The author is a craftsman who knows boys, and the toys boys will make. The designs illustrated are of a great variety and range from the decorative to those of utility.

Cloth, 132 pages; 6x9". Price, \$1.30.

Hand Work for Boys by F. Clarke Hughes, Manual Training Instructor, Spokane, Washington.

A new book of toys, artistically presented and interestingly adaptable to hand work in manual training shops. Toys, household novelties, etc., constitute the problems given in the book.

Cloth, 82 pages; 7¼x10¾". Price, \$1.50.

Hand Craft Projects, Book One by F. I. Solar, Instructor of Manual Training, Detroit, Michigan.

Contains over sixty projects which range from toys to furniture for the home. The drawings are clear, so that little explanation is necessary.

Cloth, 158 pages; 5¼x8½". Price, \$1.25.

Hand Craft Projects, Book Two by F. I. Solar.

More problems, more projects, more ideas are contained in this second book. Power driven equipment for either the school or the home shop is also illustrated.

Cloth, 168 pages; 5¼x8½". Price, \$1.25.

Manual of Gilding and Compo Work, by Charles A. Kunou, Supervisor of Manual Education, Los Angeles Public Schools, Los Angeles, California.

A guide book for workers in the arts of gilding, compo, gesso, and polychrome work. Clear definitions and descriptions of various processes and formulas and complete instructions for their application in making picture frames, book ends, lighting fixtures, gift boxes, candlesticks, plaques, etc.

Cloth, 128 pages; 7x10". Price, \$1.50.

Model Boat Building for Boys by John W. Cavileer, Hillside Jr. High School, Montclair, N. J.

Model motor boats, also three different types of model sailing yachts, ranging in size from 24" to 36". The making of hulls, etc., well illustrated.

Cloth, 72 pages; 6¼x11¼". Price, \$1.65.

Problems in Woodwork by Edward F. Worst, Director of Elementary Manual Training and Construction Work, Chicago, Illinois.

Most unusual collection of well designed problems in woodwork with special emphasis on the combination of good design, and the use of such special materials as textiles, ash, splint work, cane and seat weaving, upholstery, etc. Standard supplementary reference and teachers' text.

Cloth, 246 pages; 7½x10". Price, \$2.50.

The Bruce Publishing Company, 354 Milwaukee St., Milwaukee

The Bruce Publishing Company, Continued

25 Kites that Fly, by Leslie L. Hunt, Instructor, Thornton Township High School and Junior College, Harvey, Illinois.

Twenty-five kites that are sure to fly are described in this book. All of them can be made with common materials and with little instruction or supervision.
Cloth, 110 pages; 5¼x8¾". Price, \$1.25.

Speed Toys for Boys, by A. J. LaBerge, Instructor in Manual Arts, Bryant Junior High School, Minneapolis, Minnesota.
Contains a variety of recreational and action projects with complete instructions and plans for construction. A few of the projects are: Carts and Hobby Cars, Scooters and Wagons, Pushmobiles, Bobsleds.
Cloth, 96 pages; 7¼x10". Price, \$1.25.

Puzzles in Wood by E. M. Wyatt, Special Lecturer on Industrial Education, University of Wisconsin, Madison, Wisconsin.

This interesting book contains forty-five puzzles to be worked in wood. Puzzles range all the way from simple cut-outs to puzzles that really puzzle.

Paper, 64 pages; 5¼x8¾". Price, 60 cents.

Coping Saw Work by Edward F. Worst, Director of Elementary and Junior High School Manual Training and Construction Work, Chicago, Illinois.

Another interesting woodwork book by Mr. Worst. It contains a great variety of problems in light woodwork for the elementary manual training shop. Drawings are all full page size.

Cloth, 132 pages; 9x12". Price, \$2.40.

Advanced

Instructional Units in Wood Finishing by R. A. McGee, University of Minnesota and A. G. Brown, Stout Institute, Menomonie, Wisconsin.
Complete instructional units in wood finishing, based upon the primary jobs and the procedure necessary to prepare materials, and apply stains, fillers, varnishes, etc. Routing orders for typical finishes with routing blank forms for pupils is appended.

Cloth, 128 pages; 6¼x9¾". Price, \$1.60.

100 Problems in Woodwork by William A. DeVette, Erie, Pa.

One hundred projects of varying degrees of difficulty to supplement work for boys ahead, or behind, the average of the class. All full-page drawings with construction directions and list of materials.

Cloth, 192 pages; 6¼x10¼". Price, \$2.00.

Problems in Furniture Design and Construction by A. S. Madsen, State Teachers' College, Milwaukee, Wisconsin, and Jos. J. Lukowitz, Instructor Manual Training, Brown Street School, Milwaukee, Wisconsin.

A splendid collection of modern furniture problems. Contains many up-to-date, well-designed pieces for the home. Each project is presented by a complete working drawing. Special attention is given to the appreciation of good design in furniture.

Cloth, 132 pages; 7¼x10¾". Price, \$2.50.

More Problems in Woodwork by Edward F. Worst.

This book offers a variety of projects, many of them combining with woodwork, such other materials as reed, cane, clay or parchment. Special attention has been given to selecting problems that will occupy small floor space, as for instance, folding tea tables, reed trays, wall bookracks, end tables, etc.

Cloth, 189 pages; 10½x8¾". Price, \$3.00.

Projects in Furniture Making by Frederick A. Adams, Supervisor of Manual Training, Northampton Public Schools, Northampton, Massachusetts.

Excellent collection of standard projects; illustrated with detailed line drawings and photographic reproductions. Eighty-seven (87) plates show projects in several perspectives. Descriptions reduced to minimum.

Cloth, 96 pages; 5¼x7¾". Price, \$1.45.

Reproduction of Antique Furniture by Herman Hjorth, Director of Technical Work, Saunders Trade School, Yonkers, N. Y.

Describes art periods and designs and gives detailed instructions for the construction of many varieties of antique furniture. Contains over 200 drawings, photographs, and views.

Cloth, 198 pages; 7½x10". Price, \$3.50.

Measured Drawings of Early American Furniture by Burl N. Osburn, Principal, Washington School, Sioux City, Iowa, and Bernice B. Osburn.

Presenting a group of carefully chosen artistic pieces of early American furniture, suitable for reproduction and use in present-day American homes. Photographic illustrations, measured drawings, and complete details of construction are given.

Cloth, 80 pages; 8½x11¼". Price, \$1.80.

Furniture Inlaying, by Charles W. Frost and Margaret Fullerton.
Contains practical methods of inlaying, intarsia, marquetry, and veneering for the home and school shop. Photographs and line drawings illustrate the processes described.

Cloth, 140 pages; 7x10¼". Price, \$2.50.

A Course in Wood Turning by A. S. Milton and O. K. Wohlers.

Spindle Turning and Face Plate Turning are the two basic divisions upon which this course has been prepared. Correct design is emphasized. Illustrations clear, concise, and easily read. Contains 141 plates of projects.

Cloth, 200 pages; 6x9". Price, \$1.50.

Problems in Artistic Wood Turning by E. W. Ensinger, Arsenal Technical School, Indianapolis, Ind.

Furnishes teachers a wide variety of problems in wood turning illustrating fundamental principles and common processes of craft. Numerous, excellent detailed drawings and photographic illustrations.

Cloth, 72 pages; 7¼x10". Price, \$1.25.

Principles of Woodworking. Herman Hjorth.

An introductory text in high-school woodworking. Part I includes a rather complete statement of the tools and processes used in woodworking. Part II contains a series of very simple projects in furniture construction.

Ready Soon

Wood Pattern Making by Edmund C. Hanley, Instructor, Hackley Manual Training School, Muskegon, Michigan. Second edition.

Well graded trade jobs fix definitely the principles of patternmaking. Instructions and projects clearly illustrated and processes definitely explained. Supplementary chapters on brass furnace and a small cupola, etc.

Cloth, 208 pages; 6x9". Price, \$1.35.

Notebook for Wood Pattern Making by Herbert C. Wilcox, Instructor, The Morrill School of Mechanic Arts, Concord, N. H.

A combination text and students' notebook, presenting the fundamental principles of wood pattern making. Valuable tables, formulas and suggestions appended.

Paper, 32 pages; 6x9". Price, 35 cents.

Roof Framing by Thomas S. Rees, Vocational School, Racine, Wisconsin, and Paul C. Nelson, Stout Institute, Menomonie, Wisconsin.

An instructional aid in unit courses in roof framing. May be incorporated in complete course in carpentry. Covers all phases of framing gable, hip, valley, and dormer roofs of equal pitches.

Paper, 48 pages; 7¼x10¼". Price, 64 cents.

Essentials of Upholstery, by Herbert Bast, Upholstery Instructor, Sheboygan Vocational School, Sheboygan, Wis.

Begins with simple upholstery jobs, teaching tacking and stretching webbing, tying springs, cutting covers, etc., and progresses to upholstering on overstuffed davenport.

Cloth, 176 pages; 5¼x7¾". Price, \$1.60.

Farm Mechanics

This is the famous "Roehl" series of farm shop books that has been accepted enthusiastically by farm shop instructors everywhere. Each book is authoritative, accurate, and full of practical suggestions that can be applied to the average farm.

The Farmer's Shop Book by Louis M. Roehl, Supervisor Farm Shop Work, N. Y. State College of Agriculture, Cornell University.

A wealth of material condensed into one volume. Covers in very complete form all of this famous author's experience in wood, metal, leather, rope, etc. Very clear and definite working drawings accompany each project together with detailed description of process of work, etc. Tool lists and stock bills added, together with complete directions for carrying on the work.

Cloth, 432 pages; 6x9". Price, \$2.80.

Repairing Farm Machinery and Equipment by Gustave H. Radebaugh, Asst. Manager Shop Laboratories, Mechanical Engineering Department, University of Illinois, Urbana, Illinois.

A complete course in the repairing and maintenance of farm machinery and mechanical equipment. The illustrations and drawings are so graphic and complete and tie up the instructions in such a manner as to make the book a daily reference guide to the farmer in the best practice for repair work.

Cloth, 260 pages; 6x9". Price, \$2.75.

Automotive

Any boy is interested in the workings of the automobile. Whether you offer a course in automotive mechanics or not, you will want these books in your shop library. The tinkerer as well as the mechanic will find them an inspiration and a guide.

The Bruce Publishing Company, Continued

Automotive Essentials by Ray F. Kuns, Principal, Automotive Trades School, Cincinnati, Ohio.

A textbook for high school student drivers, organized on a definite plan of instruction. Opening chapter analyzes car as a unit, working down into vital parts, until each and every essential part has been illustrated and studied. A text designed for the boy who is or who some day will be responsible for the care of an automobile—not designed to make an automobile mechanic out of an automobile *DRIVER*.

Atho-leather, 396 pages; 6x9".

Price, \$1.92.

Automotive Trade Training by Ray F. Kuns.

A clear-cut concise basal text, in one volume and covering completely the three major divisions of Mechanical Construction, Electrical Construction and Tire care of the automobile. Only such types of equipment have been used as will fix principles. The important functioning parts of the automobile are each treated by chapter and then applied in practice to 301 job problems.

Atho-leather, 666 pages; 6x9".

Price, \$3.50.

Automotive Electrical Practice by Ray F. Kuns.

A basal text on electrical equipment of motor cars; for trade classes. Splendid as a general reference work in high schools, libraries, and garages. It takes up the principles and mechanisms of ignition apparatus, batteries, and other electrical apparatus. Numerous jobs for servicing electrical apparatus and for commercial battery shop apparatus are included.

Atho-leather, 516 pages; 6x9".

Price, \$3.50.

Battery Testing and Repair by B. B. Burling.

An actual working manual which conveys in 26 typical jobs a thorough working knowledge of battery repair and maintenance to any student.

Paper, 68 pages; 8¼x10¼".

Price, \$1.25.

Electricity

As in the woodworking shop, there is a demand for variety in the electricity classes. New projects, different methods, and the simplest and most advanced processes are included in this list.

Job Sheets for the Practical Electrical Shop by F. E. Tustison.

Thirty-five jobs teaching fundamentals of electrical wiring and electrical science. Jobs have been selected to be suitable for average available shop. Intended to develop originality and initiative in pupil.

Loose Leaf, 35 jobs; 7¼x10¼".

Price, 68c per set.

Elementary Electric Wiring by B. B. Burling, Electrical Department, Boys' Technical High School, Milwaukee, Wis., and A. M. Karweik, Instructor, Boys' Technical High School, Milwaukee, Wisconsin.

Problems on the wiring of all low voltage apparatus such as bells, buzzers, annunciators, etc., contained in this text. Stations only are given and the pupil is expected to work out the answers in conjunction with such apparatus as the school may provide.

Paper, 72 pages; 8¼x10¼".

Price, 75 cents.

Light and Power Wiring by B. B. Burling, Electrical Department, Boys' Technical High School, Milwaukee, Wis., and J. H. Lauerman, Boys' Technical High School, Milwaukee, Wis.

Strictly a trade text. The entire basis of the manual is trade practice as governed by the National Electrical Code Rules. Problems are supplied which cover practically every phase and type of wiring in homes and commercial installations.

Paper, 168 pages; 8¼x10¼".

Price, \$1.25.

Electro Craft by Leon H. Baxter.

Work begins with wiring and includes simpler circuits in open knob and cleat wiring for lighting. Interesting electrical toys and household utilities follow.

Cloth, 168 pages; 6x9".

Price, \$1.50.

Preparatory Electricity, by Beverly B. Burling.

Consists of twenty-eight electrical jobs carefully selected so as to give boys a working knowledge of the fundamental principles of electricity and of the most common applications to home and industrial uses.

Paper, loose leaf, 114 pages; 8¼x10¼".

Price, 76 cents.

Essentials of Applied Electricity, by E. W. Jones, Associate Professor of Physical Science, Kansas State Teachers' College, Pittsburg, Kansas.

Supplies a sound foundation in the elementary laws of electricity and their practical application. Contains instructions on the design and building of experimental equipment such as transformers, generators, motors, rectifiers, etc.

Cloth, 254 pages; 5½x8".

Price, \$1.36.

Practical Problems in Electrical Construction by L. Day Perry and R. O. Buck, Lane Technical High School, Chicago, Illinois.

A book containing a group of practical problems in electricity for teachers and pupils in junior and senior high schools. A plate of drawings on job sheet or unit operation basis is given with each problem. Twelve electrical shop tables are added for convenience and ready reference.

Cloth, 68 pages; 6x9".

Price, \$1.20.

Laboratory Manual of Electrical Science by R. O. Buck, and H. E. Frost, Instructors, Electrical Department, Lane Technical High School, Chicago, Illinois.

Series of fifty (50) experiments for full year's work. Explains general principles of electricity from magnetism to the simpler phases of alternating current as applied to motors and generators. Graph paper included for experiments.

Paper, 160 pages; 8¼x10¼".

Price, \$1.20.

How to Wind Direct-Current Armatures. W. E. Hennig, former Instructor in School of Engineering and Milwaukee Vocational School, Milwaukee, Wis.

Presents all the principles, the theory, the mathematics, and direct application of the principles of direct-current motor work. The last chapters give instructions for changing voltage or speed, and for transforming a motor into a generator and vice versa. Methods of testing, questions and problems, and useful tables and formulas are included.

Cloth, 205 pages; 7x10¼".

Price, \$3.00.

Metal Work

Ideas for the forge-shop student can be created by frequent reference to a variety of books, covering a variety of projects. Each book in the following list has the advantage of comprising instruction on projects of practical usefulness. They are written in a most clear and interesting way, equal to the understanding of the high-school and junior-high-school boy.

Course in Sheet Metal Work by J. W. Bollinger, East Junior High School, Sioux City, Iowa.

This is a basal introductory text for Junior High Schools and upper grades of elementary schools. Avoids theory, machine processes, sheet metal layouts and other complicated work. All problems presented in group form.

Cloth, 96 pages; 5½x8".

Price, 88 cents.

Elements of Sheet Metal Work by R. L. Welch, Instructor of Sheet Metal Work, Stout Institute, Menomonie, Wis.

A complete introductory course in sheet metal working and drafting for high schools and vocational schools. Supplementary problems in heating and ventilating, architectural problems and miscellaneous problems.

Cloth, 122 pages; 6x9¼".

Price, \$1.10.

Forge Note Book by George J. Coleman, Lane Technical High School, Chicago, Ill.

A note book, reference book and text all combined in one outline note book. Illustrations clear and compact. Course complete.

Paper, 32 pages; 5¼x9¼".

Price, 35 cents.

Notes for Forge Shop Practice by James D. Littlefield, Instructor Forging, Technical High School, Cleveland, Ohio.

An outline course in forge shop work for high school use. Begins with descriptive notes on tools and equipment, followed by numerous exercises, concise and well illustrated. Note sheets appended.

Cloth, 86 pages, 5¼x8".

Price, \$1.50.

101 Metalworking Projects, by L. C. Petersen, Southern Illinois State Normal University, Carbondale, Illinois.

101 complete working drawings and directions presented in lesson sheet form. Includes tools, electrical mechanisms, and machine equipment that form instructive foundation in metal craft.

Cloth, 214 pages; 9x6¼".

Price, \$2.00.

Printing

Texts describing and illustrating practices in the printshop to suit the needs of any school shop, and texts for handy reference are included in the following list:

The Bruce Publishing Company, Continued

Textbook of Printing Occupations by C. W. Hague, Head of Printing Department, Stout Institute, Menomonie, Wisconsin.

Based on a thorough analysis of the trade. Presents its material in three major divisions, Composition, Imposition and Platen Press Work. Each division contains exercises which are typical trade operations, arranged according to progressive difficulty.

Cloth, 258 pages; $5\frac{1}{4} \times 7\frac{3}{4}$ ". Price, \$1.00.

Printshop Practice, by R. A. Loomis, Wm. L. Dickinson High School, Jersey City, New Jersey.

Elementary compact text for beginner in printing. Simple explanations of type, type cases, composition, display, presswork, and printer's mathematics. Well illustrated.

Cloth, 104 pages; $5\frac{1}{2} \times 9"$. Price, \$1.20

Block Printing, by William S. Rice, Head, Art Dept., Fremont High School, Oakland, California.

Compact statement of methods used in making wood and linoleum blocks for printing. Describes history of art, materials, methods, etc. Many beautiful illustrations.

Paper, 48 pages; $7\frac{1}{2} \times 10"$. Price, 88 cents.

Mechanical Drawing

All shop instructors appreciate the importance of good, clear, understandable drawings, legibly lettered. Practically every phase of mechanical drawing—problems, blue prints, pictorial drawing, and all styles of lettering—is included in the Bruce Mechanical-Drawing List. The basal texts and supplementary texts included offer the finest kind of a selection, adaptable to any class.

Mechanical Drawing, First Year, by W. W. Ermeling, F. A. P. Fischer, and G. G. Greene, Chicago, Ill.

A course in mechanical drawing which is designed, first to develop the technical skill of the student, and second, to train him to visualize and reproduce simple objects by drawing. The text is substantially bound in an economical form which permits an extremely low price. Unique teaching devices in the form of cut-outs for the Four Types of Solids for studying projection. Detachable Alphabets included.

Paper, 80 pages; $6\frac{1}{4} \times 8\frac{3}{4}"$. Price, 45 cents.

Mechanical Drawing, Second Year, by W. W. Ermeling, F. A. P. Fischer, and G. G. Greene, Chicago, Ill.

Continues the work of the first year, but is in every sense a complete textbook and may be used independently of the first book. It offers very complete work in conics, sections, developments, sheet-metal work, machine drawing, and architectural drawing. Most unique applications and illustrations in the way of practical work and current trade practice.

Paper, 120 pages; $6\frac{1}{2} \times 8\frac{3}{4}"$. Price, 60 cents.

Mechanical Drafting Handbook by Frank R. Kepler, B.S., Supervisor of Industrial Arts, Department of Vocational Education, Detroit, Mich.

Provides students and mechanical draftsmen with a brief collection of usages, standards, conventions and tables based on best modern practice. Three main divisions: I. Lettering, Tools, and Drawing Procedure; II. Standards and Conventions; III. Tables.

Cloth, 124 pages; $6 \times 9"$. Price, 60 cents.

Introductory Mechanical Drawing Problems by Glenn N. Shaeffer, Dept. of Manual Arts, Wm. A. Bass Jr. High School, Atlanta, Georgia.

Junior high school text, arranged in series of ninety mechanical-drawing problems, carefully selected, progressively grouped as to method, difficulty, and progress of pupil.

Paper, 48 pages; $6 \times 9"$. Price, 28 cents.

Shop Drawing for Beginners. H. B. Cobaugh, Instructor of Mechanical Drawing, John Harris Senior High School, Harrisburg, Pa.

A simple, brief introduction to mechanical drawing for junior-high-school students. Presents the three most important elements in mechanical drawing, and provides a series of exercises for the development of skill.

Paper, 32 pages; $6 \times 9"$. Price, 24 cents.

A Primer of Blue Print Reading by Thomas Diamond, Associate Professor of Vocational Education, University of Michigan, Ann Arbor, Michigan.

Provides drill in the reading of blue prints, and incidentally develops a knowledge of the use of mechanical drawing tools. Contains excellent suggestions for teaching methods. Illustrations well drawn.

Paper, 70 pages; $6 \times 9"$. Price, 48 cents.

A Short Course in Mechanical Drawing. Wm. A. DeVette, Mechanical-Drawing Instructor, Lincoln Junior High School, Erie, Pa.

The principles and conventions of the graphic language with special application to the problems and practices of machine drawing. The material is covered in eight chapters, and the problems illustrate all the fundamental principles presented in the text.

Cloth, 140 pages; $5\frac{1}{4} \times 8\frac{3}{4}"$. Price, \$1.36.

Blue Print Reading by E. M. Wyatt, Formerly Director of Manual Arts, Houston, Texas.

A group of reference to teach artisan and apprentice simple elements in reading and understanding blue prints.

Cloth, 86 pages; $6 \times 9"$. Price, \$1.00.

Mechanical Drawing Problems by John F. Faber, Formerly Instructor Academy High School, Erie, Pa.

A group of drafting problems in blue-print form selected from thoroughly tested work. Arranged in groups according to a definite teaching order, which can be followed if desired. Problems selected from practical shop projects.

Cloth, 224 pages; $6 \times 8\frac{3}{4}"$. Price, \$2.50.

Supplementary Problems for Mechanical Drawing and Blue Print Reading by John F. Faber.

A companion text (in positive form) to the author's MECHANICAL DRAWING PROBLEMS. Contains 172 problems covering elementary freehand sketching, instrumental drawing, sections, intersections and developments, pictorial drawing, detail drawing and assembly drawings. Useful data and tables.

Cloth, 136 pages; $6 \times 9"$. Price, \$1.50.

Notes for Mechanical Drawing, Revised Edition, by Frank E. Mathewson and Judson L. Stewart.

Collection of notes, exercises and practical problems which can be adapted to any course in mechanical drawing, in any school or class. One hundred twenty-two illustrative drawings.

Cloth, 86 pages; $6\frac{1}{4} \times 8\frac{3}{4}"$. Price, \$1.48.

Brief Course in Machine Drawing by Frank E. Mathewson.

Supplementary problems to author's NOTES FOR MECHANICAL DRAWING, teaching the reading and making of simple working drawings. Fifteen plates.

Paper, 28 pages; $6\frac{1}{4} \times 9\frac{1}{4}"$. Price, 36 cents.

Inclined Lettering by R. O. Buck and H. W. Michelson, Lane Technical High School, Chicago, Illinois.

A full year course in lettering based upon fifty-six carefully selected and graded lettering exercises.

Paper, 64 pages; $8\frac{1}{2} \times 5\frac{1}{4}"$. Price, 36 cents.

Problems in Architectural Drawing by Clinton V. Bush, Director of Industrial Education, Olean, N. Y., and Edgar D. Townsley, Architect, Ithaca, N. Y.

A series of plates giving in Series A the pictorial or isometric drawings and in Series B the working drawings in orthographic projection.

Paper, 64 pages; $8\frac{3}{4} \times 11\frac{3}{4}"$. Price, \$1.08.

Mechanical Pictorial Drawing by W. W. Sturtevant, Instructor Manual Training, South High School, Minneapolis, Minnesota.

A collection of tested problems in Cabinet, Isometric and Perspective Drawing so arranged and explained that they may be effectively drawn by the average pupil. Each division is a series of plates supplied with comprehensive explanations and directions for drawing.

Cloth, 128 pages; $6\frac{1}{4} \times 9\frac{1}{4}"$. Price, \$1.36.

Shoe Repairing

Shoe Repairing by Paul E. Klein, Principal, Part Time High School, San Diego, California.

Practical text giving complete instructions for the repairing, construction and care of stitching down, McKay and nailed, turn, and welt shoes. Excellent illustrations.

Cloth, 110 pages; $5\frac{1}{4} \times 7\frac{3}{4}"$. Price, 96 cents.

Shop Records

Shop Teacher's Standard Class Record by Walter R. Cannon, Instructor Manual Training, Geneva, Illinois.

Arranged for recording students in alphabetical order, desk or table numbers, also progress of project work. Double page included for entering attendance or to record daily grades. May be used in any course.

Cloth, provides for 500 names. Price, 75 cents.

Paper, provides for 220 names. Price, 45 cents.

Course Outlines

A COURSE IN WOODWORKING FOR THE SEVENTH GRADE

L. F. Ashley, Director of Industrial Arts,
Eastern Illinois State Teachers College
Charleston, Illinois

I. Objectives

Boys in the seventh grade are likely to be full of energy and enthusiasm, eager to either create or destroy. It is our purpose to guide this energy and enthusiasm so as to have the boy want to create something useful, either for himself or for others and to make him want to do this work as well as he can. Incidentally, he will receive many of the same benefits that students are expected to get in other courses of manual training, such as knowledge of tools and tool processes, physical training, ability to work together, to appreciate things made of wood, and to create right habits of work, so that they will be of greater help to themselves and others. Much of their academic work can be profitably built around their manual training.

II. Time Allotment

Forty-five minutes per day, five days per week, for one year.

III. Outline of Course

This is a flexible series of group projects and the new tool processes taken up in each.

I. Squaring up mill-planed stock

No dimensions are given for this piece. It is to be square and as large as the piece will allow.

1. Tools

Jack plane
Try-square
Crosscut saw
Ripsaw

2. Processes

Face, edge, and end planing.
Testing for uniformity of width and thickness.

II. Squaring up stock to definite dimensions

a) Suggested projects

Counting board
Hat rack
Key rack
Windmill
Clothes stick
Ring toss
Spool holder
Game board
Laundry register

Backsaw
Brace and bits
Pencil gauge
Steel square

2. Processes

Gauging
Measuring
Lining
Backsawing
Boring
Chamfering
Getting out stock
Sandpapering

1. Tools

Marking gauge
Rule
Knife

III. Working Curves

a) Suggested projects

Sleeve boards

Bread boards

Cake boards
Scouring boards
Coat hangers
Blotting pads

1. Tools

Turning saw (coping)

Chisels
Spokeshave

2. Processes

Curve sawing
Chiseling
Spokeshaving

IV. Fastening with nails and screws

a) Suggested projects

Nail box
Polishing box
Knife box
Broom holder
Bench hook
Milk-bottle holder
Pail stand
Dish drainer

1. Tools

Hammer
Nail set
Screw driver

2. Processes

Nailing
Setting nails
Fastening with screws

V. Appreciation in design; structural, decorative

a) Suggested projects

Table mats
Calendar backs
Bill files
Glove boxes
Handkerchief boxes
Thermometer backs
Letter holders

1. Materials

Stains; Waxes

2. Processes

Structural designing
Decorative Designing
Outlining
Staining; Waxing

VI. Appreciation for birds

a) Testing initiative in design and construction. The pupil is to choose, from a magazine or a book on bird houses, some bird house to suit his own taste. The project must conform to the pupil's abilities.

b) With this project should come talks on birds, kinds, why we should take care of them, etc. At this time, talks on trees should be given.

VII. Simple joint work

a) The study of glue is not taken up in this year's work. The joints made in this group of projects are held together by nails and screws; glue being used only where necessary.

b) A list of projects introducing butt, cross-lap, dado, and rabbet joints.

1. Butt joint

Footstool
Necktie rack
Magazine rack
Paper and magazine wall rack
Shoeshining stand

2. Dado and rabbet joints

Table and desk shelves
Wall shelf

3. Cross-lap joint

Book trough
Flower and teapot stands
Plate rack

GENERAL METAL WORK IN JUNIOR HIGH SCHOOLS

Alfred B. Grayshon, J. Cooke Junior High School,
Philadelphia, Pennsylvania

Metal work has become an established part of every junior-high-school curriculum, and it has helped, to a great extent, in promoting the industrial arts in our schools.

Metal work is justified in these curriculums be-

cause of the universal uses that are made of it and the knowledge a boy should gain of the ease or difficulty of working with it, compared to other materials, regardless of his future vocation.

This work in the junior high schools is divided into two common groups: Elementary sheet-metal construction, and elementary machine and vise work. Elementary sheet-metal construction should be composed of practical projects which will appeal to the boy and be of use in the home. These objects are made of tin plate, sheet iron, galvanized iron, or sheet copper, and do not require a great deal of time for their completion. Strap iron also can be used advantageously for certain projects. Elementary machine and vise work also should be confined to projects which are useful, such as parallel clamps, hammers, plumb bobs, soldering coppers, etc., which may be made of bar stock and which require only a small amount of machining besides vise work.

Outline of Course

To develop a working knowledge of tools and materials.

A. Commence with a preliminary lecture and demonstration, showing the uses of the general hand tools required by the metal worker.

B. Devote a few minutes of each shop session to a discussion of the methods used in producing iron, steel, etc. These discussions should be illustrated by diagrams, slides, and movies, if possible.

C. Visit industrial plants.

D. Call attention to the danger of inattention and carelessness. Preach general safety. Emphasize the following points:

1. Danger of running in a shop due to the presence of sharp tools and sharp edges and corners on the metal that is being used in the shop. Also danger of accidentally pushing others against these edges and corners.
2. Danger from talking to one who is operating a machine.
3. Danger from loose sleeves or neckties near revolving parts of a machine or the flame of a gas furnace.
4. Demonstrate how to properly light the gas furnace for soldering.
5. Show the proper way of standing at a machine.

E. Demonstrate the use of the various machines or pieces of apparatus as the occasion demands.

1. Soldering furnace.
 - a) Proper point for a copper
 1. Heating
 2. Tinning
 3. Methods of soldering
 - b) Flux
 1. Different kinds
 2. How to use and where
 - c) Soldering
 1. Composition of solder
 2. Tacking
 3. Sweating
2. Bar folder
 - a) Setting for hems
 - b) Setting for wire fold
 - c) Setting stops
3. Turning machine
 - a) Changing rolls
 - b) Setting the gauge
 - c) Hold the work correctly
4. Wiring machine
 - a) Setting the work
 - b) Position of the work
5. Burring machine
 - a) Setting the guide

4. Direction of movement for soldering

- b) Holding disk work
- c) Holding square work
6. Forming rolls
 - a) Setting the rolls
 - b) Work having a wired edge
7. Cornice brake or box folder
8. Drill press

Center punching; holding by hand or vise; clamping the vise; regulating the speed; straight- and taper-shank drills; when to use oil; proper point for a drill.
9. Bench vise

Position to place work for sawing, filing, etc.
10. Lathe
 - a) Explanation of starting and stopping
 1. By rheostat
 2. By clutch
 3. When changing speeds
 - b) Use of tool holders, drills, universal chuck, adjustable chuck, faceplate, centers, dogs, and milled file.
 - c) How to center, face, turn, part, form, thread, drill, bore, file, and polish the work.
 - d) Position of the hands when operating
 - e) Position of the tools in the tool post
 - f) Necessity of oil on the dead center
 - g) Direction of tool movement
 - h) Methods of calipering the work
11. Emery wheel
 - a) Truing the wheel
 - b) Holding the work to be ground
 - c) Dry and wet grinding

F. Select projects involving the use of metal-working tools such as snips, scratch awl, scale or rule, dividers, mallet, stakes, pliers, square, riveting hammer, rivet set, center punch, straight punch, grooving tool, machinists' hammer, files, chisels, taps, dies, hack saw, and breast drill.

2. In the selection of the projects care should be used to make them practical and of such nature that a variety of materials are used. The work should start with seam soldering and then gradually take in the use of different machines. In sheet-metal work it is especially necessary to know the correct methods of forming and seaming first before doing much project work.

The materials used are as follows: Coke tin, charcoal tin, black iron Nos. 22 and 26, galvanized iron Nos. 24 and 26, copper, steel wire Nos. 10 and 14, cold-rolled steel, castings, rivets, screws and nuts.

G. Making or repairing articles for school or pupil use to show specialization in industry.

H. Use technical names in the school shop to enlarge the vocabulary of the students.

I. Use blue prints or shop sketches for all projects.

J. Provide tool catalogs, material catalogs, special trade pamphlets, and magazines for use in the school shop. These should be placed in a handy position, so that the pupil waiting for instruction, can make the best use of his time.

K. Home Repairwork.

Have the pupils bring in toys, cooking utensils, or other articles from home that need soldering, riveting, adjustment, or repairs to show carry over of knowledge learned.

L. Initiative Training

Have the pupils develop their projects on paper. Then have them cut these out to show their workableness. Criticize and suggest changes. Projects such as toy stations, churches, autos, garages, and trains may be used for this.

M. Use of Leisure

Knowledge and skill gained in school shops will help in future years in acquiring a hobby for doing odd jobs at home. Club activity, and advanced work other than regular projects, will accomplish wonderful results in boosting the pupil's ambition.

N. Citizenship

1. Neatness
2. Thoroughness
3. Accuracy
5. Respect for fellow mechanic
4. Care of property

O. Guidance

The experience gained will give a practical insight into some phases of metal-working occupations. This is a help in choosing a future vocation.

AUTO MECHANICS FOR THE NINTH GRADE

I. Introduction

The automobile has become an integral part of the American home and community. The knowledge of automobile operation, care, and upkeep, combined with road and traffic rules, is quite essential to the modern American society. Since the automobile is operated by most members of the family, the automotive knowledge need not be confined to the male sex alone, and it is well to include instruction for girls as well as for the boys.

II. Objectives

1. To develop and fix an understanding of the simple laws of automobile operation.
2. To give experience by actual contacts with the various important units of the car.
3. To be able to recognize the need of repair and make necessary minor adjustments.
4. To stimulate an interest in performing at home, some of the automotive problems carried on at school.
5. To develop and gain a knowledge of road courtesy, traffic regulation and laws.
6. To give to the pupil an insight into the magnitude of the automotive industries and its relationship to other industries with the importance the automobile and its industries play in everyday life.
7. To permit an insight into the possibilities of the various automotive fields as vocations.

III. Construction of Course

1. Systematic approach of the elementary principles of the parts, their relation and operation as found in the modern motor car.
2. Safety Campaigns.
3. Lectures coordinated with experimental shopwork and laboratory.
4. Visits to automotive plants or garages.
5. Related information integrated with shop procedure.
6. Movies pertaining to the automotive field.

IV. Instructional Procedure

1. It is necessary that the laboratory shop contain various auto parts. Units such as steering gear, water pumps, etc., should be mounted as separate units. Wall charts should be available, as they are much better than blackboard sketches for some of the work. Demonstrations should be made as in any laboratory course. The shopwork is to be carried on by instruction supplemented with information and job sheets. The demonstrations are to be actual, interesting, and dynamic in order that important phases may be retained by the stu-

dent. These demonstrations are supplemented by references from assigned magazine readings, pictures, and movies.

V. Time Allotment

Three hours per week for 10 weeks.

VI. Information to be Gained

1. Simple mechanical actions of the car.
2. Simple laws of the care and operation.
3. Applications of simple mechanical laws of mechanism.
4. Dangers of carbon-monoxide gas and how to avoid its dangers.
5. Knowledge of traffic laws and road courtesy.
6. How to properly care for the external appearances of the modern automobile.
7. Knowledge of the automotive industries.
8. Importance of the car to both American family and business life.
9. Information as to auto mechanics as a trade; training needed; demand for workers; working conditions; dangers; different fields; health and opportunities for advancement.

VII. Derivation of Skills

1. To be able to make emergency repairs.
2. To properly repair, replace, and inflate tires.
3. To properly pack a leaky water pump.
4. To clean spark plugs and set the gap.
5. To grind valves and clean out carbon.
6. To replace a leaky water hose.
7. To replace all types of gaskets.
8. To repair leaky fuel line.
9. To clean out clogged fuel line.
10. To tighten loose connections, bolts, etc.
11. To add water to battery.
12. To paint the top.
13. To remove dents from fenders.
14. To properly grease and oil the chassis.
15. Repair tire chains.
16. To renew oil-filter cartridge.

VIII. Appreciation

1. To appreciate the usefulness of the automobile in everyday life.
2. To appreciate the necessity of keeping the automobile properly conditioned throughout.

IX. Development of Traits and Habits

1. To think carefully.
2. To be prompt and punctual.
3. To clean up after each job.
4. To protect upholstered surfaces from grease, etc.
5. To develop perseverance.
6. To develop orderliness.
7. To gain accuracy.

X. Tests

1. Written. Objective type, including true and false.
2. Oral, both in laboratory and discussion periods.

3. Auto aptitude (can be made up if experience has been had in tests).

4. Working out problems as given in laboratory.

XI. Class Discussion

The class discussion can be followed very closely with outline as presented in Kuns's *Automotive Essentials*. This book is very excellent and follows a logical way of presenting the automobile.

XII. Laboratory and Shopwork (Suggestive Operations).

1. Tire repair.
2. Tire removal and inflation.
3. Body and fender repair.
4. Rubber-hose connections.
5. Radiator cleaning.
6. Body polishing.
7. Packing water pumps.
8. Clean spark plugs and set gaps.
9. Replace gaskets.
10. Refill battery.
11. Clean corroded terminal posts.
12. Pack hood to prevent rattles.
13. Grease and oil.
14. Clean reflectors.
15. Replace bulbs.
16. Change oil.
17. Grind valves and remove carbon.
18. Clean and adjust roller and ball bearings.
19. Replace fan belt.
20. Replace filter cartridge.
21. Put on tire chains.
22. Repair of tire chains.
23. Simonize body surface.
24. Dress top with top dressing.
25. Test nonfreezing solutions.
26. Test battery with hydrometer.
27. Change generator charging rate.
28. Flush out clogged radiator.
29. Sandpaper generator commutator.
30. Oil springs.
31. Focus headlights.

Major Equipment

Benches	Cell Volt Tester
Work, with vises	Distilled-Water Tank
Blowtorch, 1-qt. size	Grease Gun
Cans	Alemite
Gasoline, 1-gal. size	Zirk
Kerosene, 5-gal. size	Hydrometers
Waste	Jacks
Creepers	Roller

Small Tools

Cans, Oil, ½-pt.	Long-nose
Chisels	Chain repair
Cape, ⅜" and ⅝"	Punches
Cold, ⅝" and ¾"	Center, ¼" and ⅜"
Files	Drift, sets
Flat, 8" and 10"	Pump
Half-round, 8" and 10"	Scrapers
Fender-Repair Tools	Bearing, sets
Gauges	Carbon, sets
Thickness	Screw Drivers, selected sizes
Tire-Pressure	Snips, straight, 3" cut
Hack Saw	Soldering Coppers and handles, 1-lb. size
Adjustable frame	Spring Spreader
Blades, 18T, 10"	Split-Rim Tool
Hammers	Tire Tools, sets
Ball-peen, 4-oz.	Valve
Ball-peen, 1¼-lb.	Grinding outfits
Lead	Reseaters
Pliers	Seat reamers, sets
Combination, 6"	

Spring lifters
Wrenches
Adjustable, selected sizes
Ignition, sets
Monkey, 18"

Pipe, 10" and 14"
Rim-bolt (Universal)
Sockets, sets
Socket (Ford, Model A)
U.S.S., ¼"-⅞"

Supplies

Brushes	Penetrating
Steel	Sandpaper, Nos. 00, 0, ½, and 1
Varnish	Shellac, ½-pt. cans
Chamois	Shim Stock
Distilled Water	Solder: bar, wire, or self-fluxing wire
Gaskets	Soldering Paste
Copper asbestos	Sponges, ½-lb.
Cork and felt	Valve-Grinding Compound, coarse and fine, 8-oz. cans
Gasoline	Washers
Grease, cup, cans	Lock, assorted sizes
Kerosene	Waste
Oil	
Cylinder, light, medium, and heavy	

Suggestive Laboratory Equipment

1. Cut-away engine assembly revealing operating parts in relative position.
 2. Live engines, representative types.
 3. Pistons, rings, connecting rods, crankshaft, camshaft, valves, tappets, and timing gears.
 4. Differential assembly, independently mounted.
 5. Vacuum-tank system, independently mounted.
 6. Ignition-unit systems, independently mounted.
 7. Water-cooling systems, independently mounted.
 8. Transmission systems, independently mounted.
 9. Clutches, various types, independently mounted.
 10. Cut-away vacuum tank.
 11. Cut-away sections of radiators.
 12. Cut-away sections of steering gears.
 13. Charts and educational information from automobile companies.
 14. Chassis in running operation.
 15. Rear axles, popular car type.
 16. Cut-away unit showing differential.
 17. Wheel with drop rim, complete with casing and tube.
 18. Split rim and casing.
 19. Individual castings containing valve seats for practice valve grinding. (See *Industrial-Arts Magazine* for October, 1929.)
 20. Various types of carburetors.
 21. Generator.
 22. Starting motor.
 23. Headlight set with reflectors, bulbs, and wire.
- Note: Parts and units may be secured from local auto dealers or junkmen at little or no cost.

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COURSE IN AUTO ELECTRICITY FOR THE SENIOR HIGH SCHOOL

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The accompanying shop layout shows how a shop may be arranged to good advantage in teaching the subject of auto electricity. The course outline includes scientific experiments in electrical operation, induction, magnetism, regulation, circuits, etc. The student has actual practice in testing, wiring, and adjusting various types of starting, lighting, and ignition systems, tearing down and assembling, operating them on live motors, trouble shooting on live cars, and armature winding. Systems are taken out of cars and wired up on benches. Generators, starters, battery, switches, lights, spark plugs, and all wires are put out in front of the student. When the student is able to get the system working here, he is required to do it on the car. Electrical apparatus for different makes of cars is installed on the benches. The student wires these systems and tests them. He overhauls and repairs electrical apparatus such as magnetos, motors, and generators. These are taken apart, and repaired, just as will later be done on a customer's job.

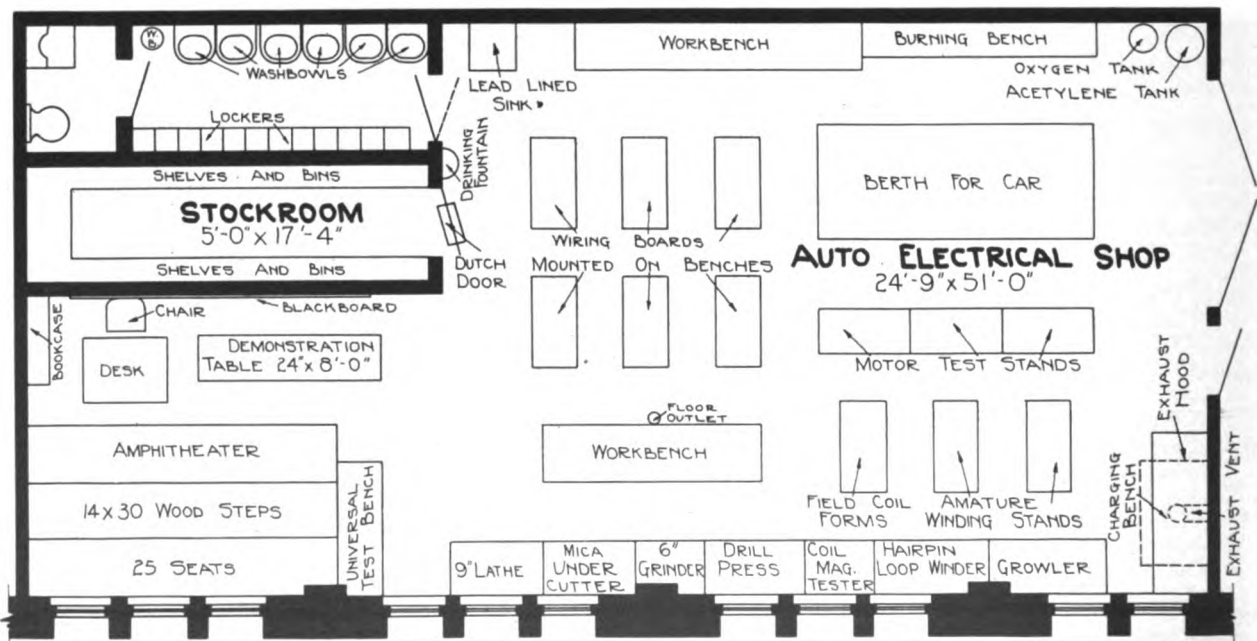
In the classroom the theory back of the construction is covered in detail, then applied to some practical problem. Lecture work and laboratory practice is planned so as to give the student the necessary familiarity with the electrical units, their construction, adjustment, and repair, and fit him for specialized work on electrical systems.

A job sheet, which contains printed directions for performing the work, together with necessary precautions, are furnished the student when he is assigned to each job. The student must then perform the work assigned, have it inspected and approved by the instructor, and be able to answer questions pertaining to the work before he is given a new job. This method of individual instruction is very satisfactory.

Referring to the shop layout, it will be seen that a part of the space is devoted to battery instruction. The battery is treated as a reservoir for the electrical energy which is required to crank the engine, supply the current for lights and ignition also. The auto battery business is a growing one, and new methods and processes are constantly being developed, while old methods are being discarded. The battery, because of its construction and performance, is a much abused and neglected piece of apparatus, which is but partly understood, even by many electrical experts. It is essential that the student understand the construction, operation, and repair of a typical starting and lighting storage battery. He must also know how to regulate operating conditions in order to obtain the best service, and he should be able to make repairs on any type of battery.

SUGGESTIVE COURSE IN AUTO ELECTRICITY

- I. *Electricity*:
 - A. Theory
 - B. Application
 - C. Conductors
 - D. Insulators
 - E. Circuits
 1. Compared with water
 2. Resistance vs. friction
 3. Switch vs. faucet
 4. Series circuits
 5. Parallel circuits
 6. Series and parallel circuits
 - F. Ohm's law
- II. *Magnetism*:
 - A. Principles
 - B. Lines of force
 - C. Polarity
 - D. Natural magnet
 - E. Permanent magnet
 - F. Electro magnet
 - G. Strength
 - H. Action
 - I. Molecules
 - J. Atoms
 - K. Electrons
- III. *Electrical measurements*:
 - A. Volt
 - B. Amperes
 - C. Ohms
 - D. Coulomb
 - E. Watts
 - F. Kilowatts
 - G. Horse power
 - H. Ampere hour
 - I. Watt hour
- IV. *Storage Battery*:
 - A. Types
 - B. Principal parts
 1. Plates
 2. Separators
 - C. Construction
 - D. Manufacturing process
 1. Lead smelter
 2. Molding lead grids and parts
 3. Pasting plates and drying
 4. Forming and cutting
 5. Cutting separators
 6. Assembling
 7. Experimental laboratory work
 - E. Electrolyte
 1. Composition
 2. Level of solution
 3. Specific gravity
 4. Freezing point
 - F. Charging
 1. Purpose
 2. Types
 3. Kinds of current used
 4. Chemical action
 5. Polarity
 6. Rate of discharge
 7. Safety
 - G. Conditions
 1. Cleanliness
 2. Overheating
 3. Undercharging
 4. Corrosion at terminals
 5. Low gravity
 6. Leaky jars
 7. Symptoms: cause; remedy



- H. Testing
 1. Ammeter
 2. Voltmeter
 3. Cadmium
- I. Repairs
 1. Open battery
 2. Eliminate sediment
 3. Eliminate short circuits
 4. Test for jar or container leaks
 5. Burning plates
 6. Assembling elements
 7. Inserting separators
- J. Care
 1. Batteries
 2. Equipment
- V. *Meter:*
 A. Principles of operation
 B. Construction
 1. D'Arsonval type
- VI. *Battery ignition systems:*
 A. Induction coil
 1. Principle
 2. Construction
 3. Types
 4. Parts
 5. Tests
 B. Timers
- VII. *Magnetic ignition system:*
 A. Application
 B. General characteristics
 C. Low tension
 D. High tension
- VIII. *Starting motors:*
 A. Application
 B. General characteristics
 C. Construction
 1. Armature
 2. Field coils
 3. Brush assembly
 D. Driving connection
 1. Bendix drive
 2. Gear ratio
 3. Chain drive
 4. Overrunning clutch
 E. Testing and repairing
 1. Observing lights
 2. Voltmeter
 3. High-reading ammeter
 4. Flash test
 5. Field coils for ground
- IX. *Generators:*
 A. Application
 B. General characteristics
 C. Construction
 1. Armature
 2. Commutator
 3. Brush assembly
 4. Bearings
 5. Frame
 D. Regulation of output
 1. Third brush
 2. Bucking series field winding
 3. Voltage regulator, vibrating type
 4. Current regulator, vibrating type
 5. Thermostat
 E. Testing
 1. Unknown type
 2. Third brush type
 3. Bucking series type
 4. Millivolt
 5. Checking circuits
 6. Armatures
 F. Repairing
 1. Rewinding
 a) Magneto armature coils
4. High rate discharge
 5. Hydrometer
 6. Thermometer
 7. Precautions
8. Assembling groups
 9. Replacing cell covers
 10. Sealing compound
 11. Burning connectors
 12. Charging
 13. Capacity test
 14. Precautions
 15. Safety
3. Shop
2. Magnetic vane type
 C. Circuits
 D. Tests
- C. Breaker points adjustment
 D. Condensers
 E. Distributors
 F. Timing
 G. Spark control
 H. Trouble shooting
- E. Operation
 F. Testing
 G. Care and maintenance
4. Frame
 5. Windings
5. Magnetic shift
 6. Manual piston shift
 7. Torque
 8. Troubles and repairs
6. Ground in armature
 7. Soldering conductors
 8. Alignment of bearings
 9. Fitting brushes
6. End housings
 7. Wirings
 8. Windings
 9. Single unit
 10. Two unit
5. Field coils: series wound; shunt wound; compound wound; shunt and "bucking" winding
 c) Armatures: lap winding; wave winding
2. Armatures
 a) Rebuilding commutators
 b) Soldering commutator leads
 c) Turning and undercutting
 d) Testing
3. Coils
 a) Forms
 b) Size of wire
 c) Number of turns
 d) Testing
- X. *Reverse current cut-out:*
 A. Application
 B. Characteristics
 C. Types
 D. Troubles
- XI. *Various electrical units:*
 A. Switches
 1. Types
 a) Starting
 b) Ignition
 c) Lighting
 B. Tests
 C. Repairs
 D. Wiring
 1. Diagrams
2. Systems
 3. Types
 4. Care
 5. Repairs
 E. Lamp bulbs
 1. Size
 2. Focus
 F. Fuses
 G. Horns
- XII. *Trouble shooting:*
- COMMON OPERATIONS IN AUTOMOTIVE ELECTRICAL MAINTENANCE AND REPAIR**
- I. *Generator:*
 1. Remove; test; repair; replace
 2. Adjust output
 3. Change field
 4. Sand commutator
 5. Turn and undercut commutator
 6. Adjusting driving chain
- II. *Cut-out:*
 1. Remove and replace
 2. Clean and adjust points
- III. *Starting motor:*
 Remove; replace starting mechanical drive
 2. Replace bendix spring
 3. Remove starter; test; repair; replace
 4. Turn commutator
- IV. *Starting switch:*
 1. Remove and replace
- V. *Ignition:*
 1. Replace and adjust contacts
 2. Replace condenser
 3. Replace coil
 4. Replace ballast resistance
 5. Replace distributor caps
 6. Retime
- VI. *Spark plugs:*
 1. Clean and adjust
 2. Install new plugs
- VII. *Wire and cables:*
 1. Replace
- VIII. *Ammeter and switch:*
 1. Replace
- IX. *Lamps:*
 1. Replace glass
 2. Replace bulbs
 3. Focus
- X. *Fuses:*
 1. Replace
- XI. *Horn:*
 1. Oil and tune
 2. Remove and replace
- XII. *Battery:*
 1. Remove; recharge; reinstall
 2. Hydrometer reading, add water, clean and tighten hold-downs
 3. Test battery with high-rate discharge test
 4. Replace rubber case
 5. Replace rubber covers
 6. Renew positive plates
 7. Build new battery
- XIII. *Carburetor:*
 1. Adjusting in connection with ignition

MECHANICAL DRAWING IN THE JUNIOR HIGH SCHOOL

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The present practice with regard to the offering of mechanical drawing on the junior-high-school level varies so greatly that it is not possible to make a suggestive outline for this work that will suit all conditions and meet the approval of all teachers.

In many schools the mechanical drawing that is offered in the seventh and eighth years is given in connection with the shopwork which these pupils are doing and is incidental rather than being considered a course in itself. This may be followed by a separate course in mechanical drawing in the ninth year that any student may take whether he takes the shopwork, or not. In some cases tryout courses in mechanical drawing are given in the seventh and eighth years, with an opportunity for specialization along this line in the last year of the junior high school or in the senior high school. In other cases the tryout course is given in the ninth year with specialization in the senior high school. Whatever plan is followed, the aim should be practically the same in all cases, the difference being in the way it is accomplished.

This outline is considered as providing material for a full unit of high-school credit on the basis of two 45-minute periods a day throughout the year, in cases where it is desired to give the course on such a basis.

Equipment for Junior High School

The following should be supplied for each pupil taking drawing. Part of this may be furnished by the pupils or it may all be furnished by the school.

Set of instruments (number and quality to be determined by the teacher or by what pupils can afford if required to purchase them).

Drawing board, about 18" x 24"
T square, 24"
30-60° triangle, 9"
45° triangle, 8"
Triangular architect's scale, 12"
Drawing paper, 11" x 15"
Thumb tacks
Eraser for pencil and ink
Cleaning eraser
2H pencil and 4H pencil
Waterproof India ink, black
Penholder and steel pens
Blotter
Tracing paper
Blue-print paper

Additional Equipment

Drawing tables or some device to enable the drawing board to be used on the woodworking bench.
Blue-print frame, 18" x 24"
Blackboard compasses
Shears, 12"
Assortment of irregular curves

Text and Reference Books

Bailey: *Mechanical Drawing for Beginners*, Manual Arts Press, Peoria, Ill.
Bennett: *Grammar Grade Problems in Mechanical Drawing*, Manual Arts Press, Peoria, Ill.

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Outline of Course

Unit No. 1

1. Unit Specifications

Two-view or three-view working-drawing sketches of simple objects which require the representation of visible outlines only and consist of surfaces at right angles or parallel to each other. Drawings full size. Each drawing to be fully dimensioned. Pencil drawing only. Have pupils draw from objects to begin with and then from pictorial sketches.

2. Information to be Acquired and Applied

Difference between working drawing and picture drawing. Correct relation of views to each other on the paper. Method of procedure in making sketches of this kind. Stages to be followed—constructive stage, dimensioning stage, finishing stage. Use of dimension line, extension line, and arrowheads. Best location of dimensions in relation to views. Character of lines in finished drawing, etc.

References: Wood, pages 1 to 11, 19 to 21. Bailey, pages 21 to 23, 25 to 30. De Vette, pages 1 to 3, 16, 17. French and Svensen, pages 21 to 30, 51 to 53. Ermeling, Fischer and Green, First year, pages 16, 17, 32, 33. Faber, (M.D.P.) page 9. Castle, pages 9, 17, 22. Shallenberger, pages 7 to 13. Faber, (T.D.) pages 5 to 17, 34 to 41.

3. Lettering

Have pupils learn the form, proportions, and correct method of making vertical numerals by the single-stroke method. Use short practice periods. Place dimensions on drawings.

4. Skills and Abilities to be Developed

To make free-hand lines fairly easily and uniformly. To observe accurately the form and relation of parts in a simple object. To visualize objects in space from pictorial sketches. To properly represent form, and to dimension correctly sketches of simple objects of this type. To make free-hand numerals fairly well.

5. Problems

Wood, problems 1, 2, 3. Bailey, problems 1,2,3,4,5. Ermeling, Fischer and Green, First year, problems 1, 3. Shaeffer, group I. Faber, plate 3, tenon; plate 4, rabbeted block; plate 5, vise anvil. Bennett, pages 17, 19, 21.

Unit No. 2

1. Unit Specification

Continue free-hand sketching. Make drawings of objects requiring the representation of invisible outlines. Give careful attention to good placing of dimensions. Work from objects and from pictorial sketches. Draw real things, not abstract exercises.

2. Information to be Acquired and Applied

Necessity for showing invisible outlines. Kind of line used for invisible outlines. Correct methods of connecting dash lines to full lines and to each other. Proper weight of line in finished drawing.

References: Wood, page 27. Bailey, pages 36 to 39. French and Svensen, page 27. Castle, page 9. Shallenberger, pages 15, 16. Faber, (T.D.) pages 5 to 17. Bennett, pages 25, 26, 29, 60 to 63.

3. Lettering

Continue practice on vertical numerals. Begin practice on vertical capitals. Have pupils memorize some approved system of forming letters of this kind. Use short practice periods. Stress rapidity and ease of action in making letters.

4. Skills and Abilities to be Developed

More skill along the same lines as in Unit No. 1. Ability to determine what views are best to draw in objects of this kind. To visualize the location of hidden lines of objects in relation to visible outlines and to represent them correctly. To make free-hand vertical capitals with some ease and accuracy.

5. Problems

Wood, problems 9, 10, 11. Bailey, problems 6, 7, 8, 9, 10. De Vette, Figure 17. French and Svensen, problem 50. Ermeling, Fischer and Green, chiseling exercise, plate 3. Faber, (M.D.P.) page 5, hollow block, page 6, both problems. Bennett, pages 27, 28, 29.

Unit No. 3

1. Unit Specification

Working drawings made mechanically, or by the aid of instruments. Have the pupils draw, by the use of instruments, several of the same objects that they have drawn by the free-hand sketching method. This will be a matter of practically copying the drawings they have already made in order to learn the correct methods of using the instruments and the correct order of procedure for such drawings.

2. Information to be Acquired and Applied

Method of fastening paper to the board. How to sharpen pencils correctly. How to use the scale correctly in measuring. Proper instruments to use and correct method of handling instruments to draw horizontal and vertical lines. How to locate and draw border and trim lines. Stages to follow when making a working drawing—constructive stage, dimensioning stage, finishing stage. Views to be drawn as a group, not singly. Correct order to follow when drawing lines in the finishing stage. Character of lines in the finished drawing.

References: Wood, pages 12 to 16. Bailey, pages 11 to 20, 31, 32. De Vette, pages 12 to 21. French and Svensen, pages 3 to 6. Ermeling, Fischer and Green, pages 18, 19. Bennett, pages 11 to 16.

3. Lettering

Continue practice in making vertical capitals. Combine letters into words and sentences and give special attention to good composition and good spacing of letters in the words. Try to develop speed and ease in making letters. Avoid slow, painstaking drawing of each letter.

4. Skills and Abilities to be Developed

Ability to manipulate the instruments correctly for the operations required in these drawings. To measure with reasonable accuracy. To draw lines uniformly and of the correct weight and character. To follow correct procedure in laying out and finishing a drawing. To make vertical capitals with fair ease and correctness.

5. Problems

Make mechanical drawings from sketches already made.

Unit No. 4

1. Unit Specification

Working drawings of objects requiring the representation of inclined lines and of foreshortened lines and surfaces. Also bring in the use of center lines as a means of facilitating the laying out of views and as a means of making more easy the clear dimensioning of a drawing. Use objects of greater complexity.

2. Information to be Acquired and Applied

How to represent foreshortened lines and surfaces. How to locate inclined lines by the method of coordinates or the method of angles. How to correctly show the dimensions of inclined lines and surfaces by coordinates or angles. How to correctly use the T square and triangles to draw

lines at 45, 60, 30, 15, and 75 degrees with any given vertical or horizontal line. How to draw lines parallel or perpendicular to each other at any angle or any position on the paper. How to lay out a drawing by means of center lines. Use of center lines as an aid in dimensioning. Character of center line. Use of dividers for setting of distances.

References: Wood, pages 15, 16. Bailey, pages 47 to 52, 56 to 59. De Vette, page 28. French and Svensen, pages 7 to 9. Bennett, pages 9 to 11, 34, 42. Shallenberger, pages 14, 15. Faber, (T.D.) page 22. Ermeling, Fischer and Green, page 19. Bennett, pages 34, 42.

3. Lettering

Continue practice on vertical capitals using smaller letters and stressing speed and accuracy.

4. Skills and Abilities to be Developed

To use triangles correctly and easily for drawing lines at various angles. To dimension correctly using center lines. To dimension correctly by angles or by coordinates. To make lower-case letters correctly.

5. Problems

Wood, problem 17. Bailey, problems 16, 17, 18, 23. French and Svensen, problems 51, 52, 53. Ermeling, Fischer and Green, plate 2, shelf brace, plate 3, try-square, half-lap dovetail joint; plate 5, V block. Shaeffer, group 3. Faber, (M.D.P.) page 11. Bennett, pages 35, 37, 39, 43, 45.

Unit No. 5

1. Unit Specification

Working drawings of objects involving plane surfaces only, but requiring to be drawn to scale. Use objects somewhat more complex than those in previous units. Present data by pictorial sketches or incomplete working drawings which are to be drawn completely by the pupil. Stress good dimensioning and strive for greater accuracy and neatness in results.

2. Information to be Acquired and Applied

Need for drawing to reduced or enlarged scale. How to determine best scale for any drawings. Kinds of scales found on the common architect's scale. How to use the scale correctly for measuring when using such ratios as $\frac{1}{2}$ " equals 1", $\frac{3}{4}$ " equals 1". How to measure when using such ratios as 1" equals 1'-0" or $\frac{1}{4}$ " equals 1'-0". How to indicate scales on the drawing and what this statement of scale really means.

References: Wood, pages 37, 38. Bailey, pages 42 to 44. De Vette, page 24. French and Svensen, pages 10, 11. Ermeling, Fischer and Green, page 23. Castle, page 19.

3. Lettering

Begin practice on vertical lower-case letters. Emphasize correctness of form and of procedure in making letters. Teach correct height of lower-case letters in relation to capitals.

4. Skills and Abilities to be Developed

Facility in the use of draftsman's scale for measuring by the proportional scales. Increased ability to use instruments correctly and easily. Greater skill in free-hand lettering. Ability to make drawings correctly to scale. To correctly dimension scale drawings.

5. Problems

Wood, problems 13, 14, 15, 22, 23. Bailey, problems 11, 12, 13, 14, 15, 19, 20, 21, 22. Ermeling, Fischer and Green, plate 2, cleat. French and Svensen, problems 55, 56, 57, 58, 59. Faber, (M.D.P.) page 22, hexagonal taboret top. Bennett, page 65, nail box.

Unit No. 6

1. Unit Specification

Drawings of objects that require the representation of circular forms, both full circles and arcs. Correct dimensioning of circles, and arcs of circles especially stressed. Give some problems that are to be laid out from center lines. Teach the value of center lines in dimensioning. Observe the correct order of drawing the circular parts in the different views. Endeavor to develop greater accuracy and speed in making drawings.

2. Information to be Acquired and Applied

Understand the compass, its parts, adjustments and proper manipulation. Order of drawing the different views

of the circular parts. How to locate centers for circles and arcs. Correct ways to show location of circles and arcs by dimensions. Correct ways of giving sizes of circles and arcs. Correct order of procedure in finishing drawings containing circles and arcs.

References: Wood, pages 47 to 50. Bailey, pages 62 to 64. De Vette, pages 22, 23. French and Svensen, pages 9, 10, 54, 55. Ermeling, Fischer and Green, pages 29, 32. Faber, (T.D.) pages 18 to 20. Bennett, pages 48, 49, 54.

3. Lettering

Continue to practice lower-case and capital letters. Letter real words and sentences and emphasize speed and facility in lettering.

4. Skills and Abilities to be Developed

To adjust and manipulate compasses easily and correctly. To properly dimension and show location of circles and arcs. To make uniform lines and accurate connections between arcs and tangents. To lay out drawings of circular forms correctly.

5. Problems

Wood, problems 18, 19, 24, 28, 29, 31, 33, 34, 64, 65. Bailey, problems 25, 26, 27, 28, 29, 30, 31, 32, 33. De Vette, Figures 18, 21, 22. French and Svensen, problems 60, 61, 62, 63, 64, 65. Ermeling, Fischer and Green, plate 2, plane blade, cam finger, plate 4, plate 5. Shaeffer, group 5. Faber, (M.D.P.) pages 12, 13, 14, 15, 16, 17, 18, 19, 20, 21. Bennett, pages 55, 57, 59, 67, 68.

Unit No. 7

1. Unit Specification

Teach tracing and blue printing. Use fair grade of tracing paper. Emphasize correct procedure and uniformity of lines. Watch for and correct difficulties found in inking. Trace, in ink, some of the drawings that pupils have previously made in pencil. Teach correct procedure in making blue prints and have pupils make several blue prints from tracings of their own drawings.

2. Information to be Acquired and Applied

How to place the drawing and the tracing paper on the board correctly. How to fill and use the right line pen and compass pen correctly. Causes of blots and irregular lines and how to avoid them. How to correctly erase an ink line. Kind of ink to use. Composition and properties of waterproof India ink. How to fill and use free-hand pen correctly. Know what blue-print paper is. Know the different printing speeds of paper. Know what takes place when a blue print is made. Know how to judge time of exposure and washing. Know how to use chemicals to improve a print. What blue prints are used for.

References: Wood, pages 94 to 98. Bailey, pages 68 to 71. French and Svensen, pages 65, 66, 67, 82. Ermeling, Fischer and Green, pages 29, 31, 32.

3. Lettering

Begin practice on inclined capitals and numerals. Give short practice periods as before and stress correct form, proportion, and slant of letters. Follow correct system of making letters.

4. Skills and Abilities to be Developed

To manipulate the pens correctly in inking and to make fairly accurate tracings. To letter in ink on tracing paper. To make good blue prints by the sun-printing method.

5. Problems

Make tracings of drawings already made in pencil.

Unit No. 8

1. Unit Specification

Drawings of objects that require sectional views in order to represent them clearly. Objects to consist of a single piece of material where section is cut. Have at least one inked tracing made of this type of drawing.

2. Information to be Acquired and Applied

What sectional views are and the need for such views. What crosshatching is and its purpose. Kind and spacing of lines to use in crosshatching. Correct relation of sectional views to other views of the drawing. How to determine when sectional views are needed and where section should be taken. Use of reference lines to designate place where section is taken. Omission of hidden lines on sectional views. Dimensioning sectional views.

References: Bailey, pages 78, 79. De Vette, pages 33,

34. French and Svensen, page 34. Ermeling, Fischer and Green, page 58. Faber, (M.D.P.) page 73. Castle, page 12. Shallenberger, pages 19 to 22. Faber, (T.D.) page 21. Bennett, page 48.

3. Lettering

Continue letter practice on inclined capitals and numerals.

4. Skills and Abilities to be Developed

To determine the need of sectional views in simple drawings. To represent sectional views correctly. To cross-hatch correctly. To draw crosshatching lines uniformly. To dimension drawings with sectional views correctly. To make a good tracing of a drawing with sectional views.

5. Problems

Wood, problem 45. Bailey, problems 34, 35, 36, 37. De Vette, Figures 32, 33, 34, 36. French and Svensen, problems 66 to 69. Ermeling, Fischer and Green, plate 4, plate 12, first six problems. Shaeffer, group 6. Faber, (M.F.P.) plates 37 to 50. Bennett, page 49.

Unit No. 9

1. Unit Specification

Drawing of objects consisting of more than one piece of material which need to have sectional views shown. Teach the use of partial sections, revolved sections, detail sections, and conventional breaks.

2. Information to be Acquired and Applied

How to crosshatch sectional views through more than one piece of material. Understand half-section and full-section views and the advantages of each. Know the meaning of revolved section, partial section, detail section, and when to use each. Know the common conventional breaks.

References: Wood, pages 83, 86, 87. Bailey, pages 81, 84, 85. De Vette, pages 38, 39, 40, 42. French and Svensen, pages 36, 37. Ermeling, Fischer and Green, page 58. Castle, page 15. Shallenberger, pages 22 to 30.

3. Lettering

Begin practice on inclined lower-case letters. Give attention to correct form of ovals.

4. Skills and Abilities to be Developed

Ability to correctly crosshatch sectional views through several pieces of material. Ability to make use of partial sections, revolved sections, etc. Greater skill in inking drawings and in lettering. Ability to make correct drawings with little help from the teacher.

5. Problems

Wood, problems 41, 42. Bailey, problems 38, 39, 40, 41, 42, 43, 44, 45. De Vette, Figures 35, 39. French and Svensen, problem 70. Faber, (M.D.P.) plate 51.

Unit No. 10

1. Unit Specification

Drawings of articles in sheet-metal construction, consisting of plane surfaces only, which require the laying out of surface patterns. Begin with simple forms, such as a tray with slanting sides, and teach the principles of surface developments. Deal with the problem of finding line of intersection of surfaces and true lengths of foreshortened lines. Emphasize, especially, the ability to visualize lines and points in space. Use simple, concrete problems.

2. Information to be Acquired and Applied

Difference between the drafting problem when the object is made of solid materials and when it is hollow and constructed of bent or shaped metal or other materials. The meaning of developments, or surface patterns. How to use elements, or straight lines on the surface of an object, as a means of locating points in line of intersection and on sectional views, etc. How to decide what elements to use. How to determine, from the views of an object, whether a line is shown in its true length or foreshortened. How to find the true length of a line. Know how to find, by projection, the position of a point in any view if shown in the other two views. Allowance for laps in sheet-metal layouts.

References: French and Svensen, pages 113 to 116. Ermeling, Fischer and Green, pages 62, 63, 64. Wood, page 99.

3. Lettering

Continue letter practice as before.

4. Skills and Abilities to be Developed

Be able to visualize lines and points in space and to see clearly their relationship and position in the different views

of the object. To find true lengths of lines. To transfer points correctly from projection views to developments. To determine laps correctly. Increased skill in making fine lines, determining points accurately and measuring correctly.

5. Problems

French and Svensen, problems 126 to 139. Ermeling, Fischer and Green, plates 5, 6, 7. Faber, (M.D.P.) plates 55, 56, 57.

Unit No. 11

1. Unit Specification

Drawings of sheet-metal problems that involve curved outlines and the development of curved surfaces. Use real projects that are simple enough for the pupils to deal with. Stress the underlying principles upon which such problems are solved so that pupils can solve other problems of the same kind. Have pupils learn that the understanding of these principles is the important thing, not just knowing how to solve some specific problem, for they may never need to solve these identical problems again but may need to apply the principles to the solution of other problems.

2. Information to be Acquired and Applied

How to place elements upon curved surfaces as the basis for the solution of such problems. How to find these elements in the other views and to locate points upon them. How to measure the length of curved lines and to transfer this length to straight lines or to other curved lines. How to draw irregular curves and to use the French curve correctly.

References: Wood, pages 99 to 103. French and Svensen, pages 117 to 125, 127 to 132. Ermeling, Fischer and Green, pages 64, 72.

3. Lettering

Continue letter practice as before.

4. Skills and Abilities to be Developed

Ability to see elements clearly and to represent them correctly in all views. To measure and transfer lengths of curved lines accurately. To use curves correctly and make smooth curved lines. Ability to lay out surface patterns of curved forms.

5. Problems

Wood, problems 49, 50, 53. French and Svensen, problems 140 to 156. Ermeling, Fischer and Green, plate 8, cylinder, cone, plate 10, plate 11, plate 12, last three problems, plate 57, plate 66.

Unit No. 12

1. Unit Specification

Simple problems in architectural drawing. Plans and elevations of small structures such as chicken houses, playhouses, garage, etc. Do not simply copy drawings but have pupils learn to express their own ideas through the drawing, to use correctly the conventions of architectural drawing and to understand the simpler types of building construction.

2. Information to be Acquired and Applied

Meaning of plan and elevation. Methods of representing walls, doors, windows, and other details. Conventions for electrical equipment, plumbing fixtures, heating plant, etc. Standard sizes of doors, windows, etc. How to use projection when drawing elevations. How to plan simple stairs. Planning roof, pitch, rise, run, span. Simple cornices. Represent siding, brick, shingles. How to dimension plans, elevations, and details.

References: French and Svensen, pages 113 to 116, 126. Ermeling, Fischer and Green, pages 62, 63. Bush, Bush and Townsley, Seaman, Elwood.

3. Lettering

Practice architectural style of letters, capitals only.

4. Skills and Abilities to be Developed

To make architectural letters fairly well. To use architect's scale readily. To correctly draw plans and elevations of small structures. To plan simple stairs and roofs. To dimension architectural drawings. To use standard mill books and other helps. To make good tracings of architectural drawings.

5. Problems

Wood, problems 61, 62, 63. French and Svensen, problems 187 to 192. Additional problems may be found in the books by Seaman, Bush, Bush and Townsley, Elwood, and others.

SHEET-METAL WORK FOR THE JUNIOR HIGH SCHOOL

I. Introduction

Junior-high-school sheet-metal instruction should provide contacts which will enable the student to gain some knowledge of occupational requirements and vocational possibilities of the metal trades and their associated industries. It is also just as important that the instruction provide opportunity whereby the student may construct simple, useful problems without the aid of an extensive tool and machine equipment. Special machines for commercial operations may be observed in visits to commercial sheet-metal establishments.

II. Objectives

1. To develop and fix an understanding of the methods employed in shaping products from sheet metals.
2. To give an appreciation of sheet metal as used in everyday life and industry.
3. To teach how to recognize sheet metals from the standpoint of kind, gauge, material, and protective coatings.
4. To stimulate an interest in constructing at home, sheet-metal projects which require operations that have been learned at school, and to develop from other sheet-metal articles, something else of material value.
5. To give the pupil an insight into the possibilities of sheet-metal trades as a vocation and aid him in finding himself.

III. Construction of Course

1. A very progressive presentation of the simpler aspects of sheet-metal operations.
2. Sheet metal correlated with sheet-metal drafting.
3. Related trade information is made an integral part of the course.

IV. Instructional Procedure

1. Demonstrations of sheet-metal operations should be given as group problems or individual instruction. Personal instruction is necessary and may be supplemented with job and instruction sheets.

V. Time Allotment

Not less than 120 minutes per week for a period of 9 or 10 weeks.

VI. Information to be Gained

1. Simple methods of shaping sheet metals.
2. Simple methods of cutting sheet metals.
3. Kinds of metals and their value for different uses.
4. Methods of manufacturing sheet metals.
5. Working knowledge of use of special machines.
6. Methods of fastenings used on sheet metals, such as rivets, soldering, sweating, seaming, etc.

7. Spelling of common terms.
8. Simple layout of sheet-metal patterns.
9. Proper care of sheet-metal projects.
10. Knowledge of compositions of solder.
11. Knowledge of purpose, kinds, dangers, and composition of fluxes.
12. Information to the sheet-metal occupations as a profession, training needed, demand for workers, different fields, dangers, conditions affecting health, and opportunities for advancement.

VII. *Derivation of Skills*

1. To be able to cut accurately the various sheet-metal layouts.
2. To lay out simple patterns.
3. To join pieces and ends as one, by solder, seaming, riveting, and sweating.
4. To be able to use the simple machines for simple operations.
5. To be able to form simple shapes in sheet metals.
6. To be able to record neatly and accurately results of sheet-metal procedure.
7. To properly tin and handle the soldering copper.

VIII. *Appreciation*

1. To be able to appreciate the important part that sheet metal plays in everyday life and industry.

IX. *Development of Traits and Habits*

- | | |
|--------------------------|-------------------------------|
| 1. Systematic procedure. | 6. Accuracy to a fair degree. |
| 2. Initiative. | 7. Neatness. |
| 3. Industry. | 8. Perseverance. |
| 4. Courtesy. | |
| 5. Altruism. | |

X. *Tests*

1. Written: Objective test questions, including true and false.
2. Oral: Both in shop and discussion periods.
3. Mechanical aptitude if procurable.

CLASS DISCUSSION

I. *Materials*

- | | |
|---------------------|------------------|
| 1. Tin. | 5. Brass. |
| 2. Black iron. | 6. Copper. |
| 3. Galvanized iron. | 7. Zinc. |
| 4. Lead. | 8. Metal paints. |

II. *Specification of Materials*

1. Standard tables.
2. Trade terms.
3. Gauges.
4. Thickness in inches and decimal equivalents corresponding to gauge.
5. Size of sheets.

III. *Solders and Fluxes*

- | | |
|--------------|-------------------------------|
| 1. Solders. | b) Rosin. |
| 2. Fluxes. | c) Tallow. |
| a) Cut acid. | d) Soldering salts and paste. |

IV. *Layout of Problems*

1. Use of layout tools.
2. Cutting with cutting tools.
3. Seams, laps, and amounts for each.
4. Use of templates.
5. Mathematical calculations.

V. *Methods of Joining Pieces*

1. Soldering.

2. Riveting.
3. Sweating (cleaning and tinning).
4. Seaming.
5. Wiring.

VI. *Purpose and Use of Simple Machines*

1. Correct use, operation, and care of machine.
2. Purpose and value of machine.

VII. *Value of Sheet Metals to American Life*

1. Uses of Metals.
 - a) In the home.
 - b) Automobile.
 - c) Preserving foods.
 - d) Furniture.
 - e) Etc.
2. Occupations created and employment given due to extensive use of sheet metals.

VIII. *Sheet-Metal Working as a Trade*

1. Skill needed.
2. Various aspects of the trade.
3. Demand for workers.
4. Salary in the various lines of occupations.
5. Health.
6. Dangers.
7. Employment seasonal or year-round.
8. Time needed to learn trade.
9. Wages given while learning trade.

OPERATIONS IN SHEET METAL

- | | |
|------------------------------------------------|-------------------------------------------|
| 1. Layout. | 12. Forming on stakes. |
| 2. Cutting. | 13. Turning edges with machine. |
| 3. Folding edges. | 14. Wiring edges with machine or by hand. |
| 4. Forming cylinders with rolls. | 15. Tinning a soldering copper. |
| 5. Forming with a brake. | 16. Raising. |
| 6. Riveting. | 17. Stretching and flanging. |
| 7. Sweating. | 18. Punching holes in sheet metals. |
| 8. Grooving. | 19. Drilling holes in sheet metals. |
| 9. Crimping. | |
| 10. Burring edges with machine. | |
| 11. Setting down seams with hammer or machine. | |

EQUIPMENT

- | | |
|--------------------------|-----------------------------|
| 1. Straight snips | 15. Steel squares 18" x 24" |
| 2. Circular snips | 16. Straightedges (steel) |
| 3. Set of grooving tools | 17. Hand folder |
| 4. Riveting hammers | 18. Pliers |
| 5. Setting-down hammer | 19. Gas furnaces |
| 6. Flaring hammer | 20. Soldering flux |
| 7. Hollow punches (set) | 21. Stakes |
| 8. Solid punches (set) | a) Beakhorn, No. 2 |
| 9. Assorted cold chisels | b) Blowhorn |
| 10. Scratch awls | c) Needle case |
| 11. Wood mallets | d) Square stake |
| 12. Dividers | e) Hatchet |
| 13. Circumference rule | 22. Hollow mandrel |
| 14. Screw drivers | |
| Machines | 4. Bar folder |
| 1. Turning machine | 5. Burring machine |
| 2. Wiring machine | 6. Forming roll |
| 3. Beading machine | 7. Squaring shears. |

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ELEMENTARY ELECTRICITY FOR THE JUNIOR HIGH SCHOOL

I. Introduction

Electricity is rapidly replacing steam as a means of power in the industrial field. Numerous railroad companies are electrifying many miles of their roads. The average American home has changed due to the increasing utilization of electric energy in the home. In fact, we find that this tireless worker is used to light our homes, cook our meals, heat our rooms, wash our dishes and clothes, carry our voices over a wire, and provide entertainment through the radio, and it plays an important role in that great American necessity, the automobile. It may be truly said that electricity has changed our entire mode of living.

Therefore, opportunity should be provided to the junior-high-school youth to gain knowledge and information relative to one of the world's greatest and most promising fields—electricity. It is hoped that the instruction will provide a rich background of fundamentals and at the same time give a training which will enable the boy to intelligently and properly care for the electrical servant in the home.

II. Objectives

1. To teach simple and fundamental laws pertaining to magnetism and electricity.
2. To teach the simple laws pertaining to current flow, resistance, and pressure.
3. To provide opportunities for handling low-voltage currents.
4. To provide opportunities of an exploratory nature which will allow for a better counseling and guidance program.
5. To coordinate the home and school by a mutual exchange of problems.
6. To provide a training which will enable intelligent and safe operation of electrical home appliances.
7. To provide instruction in reading and writing the electrical language of industry.

III. Construction of Course

1. A progressive presentation of the most simple aspects of electrical phenomena.
2. The shopwork, experiments, and lectures should be related. All information must be within the student's scope, and be presented previous to the shop application which involves the use of such information.
3. Trade and general information pertaining to electricity should be presented in order to broaden the student's scientific background.

IV. Instructional Procedure

Due to the fact that electricity is invisible, elec-

trical courses should not be too theoretical, and "talked demonstrations" should not be used by the instructor. It is necessary that provision be made whereby the student cannot only observe the actions of electricity, but may have opportunity of performing similar experiments within his ability.

Therefore, an electrical shop for the junior high school should contain many simple pieces of electrical apparatus for the purpose of showing the performances of electricity and magnetism.

The shopwork should be supplemented with magazine reading, job sheets, and information sheets. A shop library would increase the value of the course. Demonstrations should be dynamic in order to emphasize the important parts of the work.

V. Time Schedule

Not less than 120 minutes per week for 9 or 10 weeks. Five 60-minute periods per week allow for a much richer instruction.

VI. Information to be Gained

1. Simple laws pertaining to current flow, resistance, and pressure.
2. Simple aspects of magnetic phenomena.
3. Dangers involved in the handling of electricity and how to safeguard against them.
4. Interpretation of electrical diagrams.
5. Interpretation and correct spelling of electrical terms.
6. Proper care and use of the electric appliances in the home.
7. Vocational possibilities in the electrical field.
8. Knowledge of simple series and parallel connections.

VII. Derivation of Skills

1. Ability to do simple repair of electrical devices as found in the home.
2. Ability to make series and parallel connections.
3. Ability to join and solder electrical splices.
4. To splice, solder, and re-cover heater cords.
5. To connect switches, terminals, clips, screws, and battery connections to conductor wires.
6. To write with a fair degree of skill the industrial electrical language.
7. To interpret the written electric language.
8. To insulate and wind simple coils for use in elementary electrical projects.
9. To erect wiring problems, such as bell circuits, low-voltage lamp circuits, etc.

VIII. Tests

Objective-type tests should be used. They should include the true and false, multiple-choice, and other modern types. The instructor may build his own tests to fit into his instruction.

Topic for Discussion	Related Information	Apparatus, Material, and Needs for Explanation and Demonstration
I. First Principles of Electricity		
1. Kind.	Static Electricity	Pith ball or new small cork hung by silk thread; silk cloth glass rod; flannel cloth; rubber rod; burnt-out lamp bulb. Reference: <i>Essentials of Electricity</i> . Jones.
	Current Electricity	Choice of dry cells, storage battery, small generator, or magneto; low-voltage bulbs; miniature bulb sockets, conductor wire. Illustrated Wall Charts and Diagrams.
2. Electric Currents.	Kinds— <i>a.c.</i> and <i>d.c.</i> Hydraulic analogy applied to current flow, voltage, and resistance. First approach to Ohm's Law.	
3. Current Effects.	1. Physical: a) Medical treatments. b) Electric shock. c) Care of person who has been subjected to shock. 2. Mechanical motors. 3. Magnetic: Bells and buzzers. Telegraph. 4. Chemical: a) Storage battery.	Device to illustrate current effects.
4. Conductors and nonconductors.	Conductors— Brass, aluminum, copper, iron, nickel, lead, german silver, etc. Nonconductors— Stone, marble, slate, porcelain, shellac, rubber, mica, glass, etc. Wire, wire sizes, and coverings.	Samples of conductors. Samples of nonconductors. Wire gauge and wire samples of various kinds and coverings.
5. Cells.	1. Primary cell. Construction and characteristics. Types of cells and value of each. Definition of a cell. 2. Secondary cell. Definition. Composition and construction. Value of secondary cell.	Dry Cell. Wet Cell. Storage battery and storage battery in section.
6. Electric Circuits.	1. Definition of an electrical circuit, closed circuit, grounded circuit, open circuit. 2. Grouping of cells and electrical pieces in simple series and parallel arrangements.	Circuits of various kinds on illustrative wall charts. Electrical pieces; dry cells; conductors.
7. Protective Devices.	1. Fuses: Plug. Cartridge. 2. Purpose. 3. Size and how specified. 4. Danger of insertion of a copper penny as a fuse substitution.	Fuse box containing fuse cut-out bases for plug and cartridge fuses. Samples of the various types of fuses in use in the home and industry.
8. Electric Current—regulation and control.	1. Resistance. 2. Ohm's Law, and its application. 3. Effects of adding resistance. 4. Heating effects. 5. Rheostats.	Current source. Resistance wire. Rheostats. Conductors. Electrical pieces.
II. First Principles of Magnetism		
1. Magnetism.	1. Natural magnets. Artificial magnets. Permanent magnets.	Suspended lodestone. Soft piece of iron. Permanent magnets. Horseshoe or bar.
2. Magnetic and nonmagnetic materials.	Comparison of iron and steel alloys with brass, copper, aluminum, and zinc. Property characteristics of soft iron and steel after being brought under influence of magnetic forces.	Examples of magnetic substances. Examples of nonmagnetic substances. Horseshoe magnet.

Topic for Discussion	Related Information	Apparatus, Material, and Needs for Explanation and Demonstration
3. Poles of Magnets.	<ol style="list-style-type: none"> 1. Polarity of magnets. 2. The earth as a magnet. 3. Magnetic fields from pole to pole. 4. Laws of like and unlike poles. 5. Strength of magnets. 6. Magnetic Compass. 	<p>Bar and horseshoe magnets. Magnetic (small) compasses. Iron filings, plate glass.</p>
4. Theory of Magnetism.	<p>Molecular theory. Molecular friction in steel as compared to soft iron.</p>	<p>Magnetized hack-saw blade which may be broken into an indefinite number of pieces to illustrate the molecular theory.</p>
5. Electromagnetism.	<ol style="list-style-type: none"> 1. Magnetic whirl about a conductor carrying current. 2. Relation of current direction relative to magnetic whirl. 3. Rule relative to current and whirl. 	<ol style="list-style-type: none"> 1. Source of direct current of low voltage. 2. A conductor passing at right angles through a glass or wood plate. 3. Iron filings. 4. Conductor carrying current and magnetic compass.
6. Solenoid.	<p>Magnetic field around coil carrying current. Action of magnetic whirl about two adjacent parallel conductors carrying current in same direction. Action of magnetic whirl about two adjacent parallel conductors carrying current in opposite directions.</p>	<p>Wire solenoid threaded through piece of panel; current; iron filings; apparatus containing suspended conductors free to move. The conductors should be so fixed that they may permit current to pass through the two conductors suspended with lower end in mercury, in the same direction of travel or in a manner which allows current to travel up in one conductor and down in the other.</p>
7. Electromagnets.	<ol style="list-style-type: none"> 1. Insertion of core of iron into solenoid. <ol style="list-style-type: none"> a) Purpose. b) Value. 2. Strength of an electromagnet. 3. Ampere turns. 4. Polarity of electromagnet. 	<p>Solenoid, current source, iron core. Magnetic compass. Iron filings.</p>
8. Use of Electromagnets.	<ol style="list-style-type: none"> 1. Electric bells. 2. Telegraph. 3. Telephone. 4. Furnace controls. 5. Unloading pig iron. 6. Handling kegs of nails. 7. Etc. 	<p>A pipe cap converted into an electromagnet, and fastened to a heavy cord which is threaded through a pulley fastened to the ceiling, allows for some striking demonstrations.</p>
9. Electric Bells, Telegraph Annunciators.	<ol style="list-style-type: none"> 1. Bell construction. 2. Principle of operation. 3. Methods of connecting bells, telegraph instruments, and annunciators in circuits. 4. Bell troubles. 	<p>Bells, wire, push buttons, insulated staples, dry cells, or storage battery. Telegraph instruments. Annunciator.</p>
10. Motor Principle.	<ol style="list-style-type: none"> 1. Reaction between the magnetic whirl about a conductor and a magnetic field in which it is contained. 2. Pole pieces. 3. Armature. 4. Frame. 5. Brushes. 	<p>Apparatus—a conductor in a magnetic field, free to move on a pivot. Simple electric motor. Low voltage source.</p>
11. Elementary Generator Principle.	<p>Very elementary principles.</p>	

SUGGESTIVE LABORATORY PROBLEMS AND PROJECTS

1. Construction of a simple cell.
2. Wire Splices—rat-tail, end splice, top splice.
3. Electrician's knot.
4. Soldering and taping—fastening wire to terminals, clips, and screw connections.
5. Connecting dry cells in series and parallel arrangements to illustrate current flow and pressure.
6. Drawing simple wiring diagrams, using conventional symbols.
7. Wiring electric pieces in series and parallel arrangements.
 - a) Bell and buzzer circuits.
 - b) Miniature lamp circuits.
8. Control of current with rheostat in use with miniature lamps.
9. Replacing fuses, plug and cartridge types.
10. Experiments with all kinds of magnets.
11. Determining path of a magnetic field by use of iron filings or compasses.
12. Making of small electromagnet.
13. Construction of simple buzzer or electric toys.
14. Experiments with magnetic and nonmagnetic substances.
15. Experimental work with simple low-voltage toy motor.
16. Transformer connections for toy-train work.
17. Repair and care of Christmas-tree lights.
18. Wiring telegraph instruments.
19. Wiring annunciator system.
20. Reading an electric meter.
21. Simple repair of electric home appliances.
22. Re-covering heater cord.
23. Installing feed-through switches.

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A JUNIOR-HIGH-SCHOOL PRINTSHOP COURSE

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The following course of study has been arbitrarily divided into thirty assignments. All of the assignments are divided into three parts.

Part I consists of written work on informational topics presented in chart form, or as brief outlines that are to be entered in the student's notebook.

Part II consists of library or homework.

A. Trade terms to be looked up in the glossary of the textbook.

B. An historical or trade question to be looked up in the encyclopedia or a book on printing.

Part III. Shopwork consisting of assignments planned according to the operations they involve.

Time Required

The time required to complete an assignment will, of course, depend upon the length of periods and the frequency of classes. The average pupil will complete one assignment in five 55-minute periods. Some eighth- and ninth-grade pupils will do the work considerably faster, while seventh-grade pupils will require a longer time. A lack of familiarity with the library and with methods of looking up data partly accounts for the slowness of seventh-grade pupils.

Outline of Assignments

Assignment I

Information:

- Job 1. Lettering and drawing for shop notes.
- Job 2. Printer's system of measurement.
- Job 3. The California Job Case.
- Job 4. Letters difficult to distinguish.

Library and Homework:

- Job 5. Define case; stick; galley; type metal; quads; spaces; nicks; upper case; lower case; brayer; proof press; pi. Who was Johann Gutenberg? Laurens Coster?

Shopwork:

- Job 6. Set one paragraph of straight composition, pull proof, clean, and distribute.

Tests: Covering current week's terms, drawing and lettering, measurement problem, and history.

Assignment II

Information:

- Job 1. Justification of a line of type. Detailed trade practice.

- Job 2. Proofreading.

Library and Homework:

- Job 3. Define stickful; path line; proof; pull a proof; measure; alloy; benzine; thick spaces; thin spaces; flush; type gauge; copy. What contribution did the Phoenixians make to the art of written expression?

Shopwork:

- Job 4. Straight composition.
- Job 5. Straight composition.
- Job 6. Straight composition.

Tests: Covering definition of terms, spacing and measurement problems, drawing the case, and history.

Assignment III

Information:

- Job 1. The anatomy of a letter.
- Job 2. The parts of a piece of type.

Library and Homework:

- Job 3. Define doublet; composition; break line; alignment; alley; stand; indentation; high spaces; subhead; numerals; ligature; punctuation. Who was Nicholas Jenson?

Shopwork:

- Job 4. Straight composition.
- Job 5. Straight composition.
- Job 6. Straight composition.

Tests: Covering definition of terms, spacing and measurement problems, proofreading, parts of piece of type, history.

Assignment IV

Information:

- Job 1. Imposing simple forms.
 - a) Furniture-within-furniture method.
 - b) Chaser method.

Library and Homework:

- Job 2. Define quoin; lead; slug; chase; lockup; mallet; planer; composing; typography; graphic arts; type high; lift. What were cuneiform characters and by whom were they used?

Shopwork:

- Job 3. Straight composition.
- Job 4. Straight composition.
- Job 5. Lockup of a form of linotype slugs by furniture-within-furniture method.
- Job 6. Lockup of form of linotype slugs by chaser method.

Tests: Covering definition of terms, parts of a letter, measurement problem, justification and paragraphing, and history.

Assignment V

Information:

- Job 1. Rules of grammar and punctuation for printers.
- Job 2. The lead and slug case.
- Job 3. Tying up a form and making corrections.

Library and Homework:

- Job 4. Define furniture; imposing; imposing stone; revise; solid matter; first proof; galley proof; dirty proof; clean proof; quoin key; off its feet; corrections. Find out all you can about early Chinese printing.

Shopwork:

- Job 5. Composition of a group of numbered items.
 - a) Composition.
 - b) Tie-up, proof, and proofread.

- c) Correct.
- d) Pull revise proof.

Job 6. Oil press.

Tests: Covering definition of terms, measurement problem, imposition problem, capitalization and period, history.

Assignment VI

Information:

- Job 1. Name and sizes of commercial paper stocks.
- Job 2. Names and sizes of books.

Library and Homework:

- Job 3. Define case rack; galley rack; compositor; batter; apprentice; journeyman; dub; dead line; body type; body; black letter; bottled. Find out all you can about Pierre Simon Fournier.

Shopwork:

- Job 4. Poetry composition.
- Job 5. Poetry composition.
- Job 6. Poetry composition.
- Job 7. Poetry composition.

Tests: Covering definition of terms, imposition problem, punctuation and spelling, history.

Assignment VII

Information:

- Job 1. Common type faces and their designations and uses, including a list of the sizes most frequently used, and the old names for each size.

Library and Homework:

- Job 2. Define follow copy; stone; proofreader; full stop; sidehead; copyholder, marks; jet; form; put up; dash; leaders. Who was William Caxton?

Shopwork:

- Job 3. Poetry composition.
- Job 4. Poetry composition.
- Job 5. Poetry composition.
- Job 6. Poetry composition.

Tests: Covering definition of terms, punctuation and grammar, proofreading, composition test, and history.

Assignment VIII

Information:

- Job 1. Classification of type faces.

Library and Homework:

- Job 2. Define initials; bastard; set-wise; insert; expanded type; overrunning; Gothic; belly; body matter; bank; headline; condensed type; Who was William Caslon?

Shopwork:

- Job 3. Ink the press.
- Job 4. Composition of headlines.
- Job 5. Wash the press.
- Job 6. Composition with two- or three-line initial.

Tests: Covering definition of terms, classification of type faces, measurement problem, imposition problem, and history.

Assignment IX

Information:

- Job 1. Composition of printers inks. Kinds of inks.
- Job 2. Mixing of inks and color theory.

Library and Homework:

- Job 3. Define gauge pins; impression; drying rack; job printing; ink disk; press proof; bed; cut; family; font; pigment; grippers. Who was Gianbattista Bodoni?

Shopwork:

- Job 4. Composition with $2\frac{1}{2}$ - or $3\frac{1}{2}$ -line initial.
- Job 5. Composition with initial letter in margin.
- Job 6. Imposition of double form.
- Job 7. Simple make-ready.
- Job 8. Feed press—no form.

Tests: Covering definition of terms; colors, primary and secondary; composition of inks; grammar for printers; history.

Assignment X

Information:

- Job 1. Balance and harmony.
- Job 2. Layouts.

Library and Homework:

- Job 3. Define optical center; small caps; layout; platen; composing rule; matter; balance; guards; job press; guides; complementary colors; caps. In what way was Benjamin Franklin an outstanding printer?

Shopwork:

- Job 4. Composition of simple blank form using leader. This job to be carried through to completion, including padding.

Tests: Covering definition of terms, measurement problem, leads and slugs, kinds of type faces, grammar, history.

Assignment XI

Information:

- Job 1. Casting off space and copy.
- Job 2. Kinds of paper and uses.
- Job 3. Splicing leads and slugs.
- Job 4. Double and triple cap case.

Library and Homework:

- Job 5. Define feed edge; bring up; drawsheet; collate; tympan bales; tympan; pressboard; bearers; fountain; bind; spotting; roller; roller composition; registering; register sheets.

Shopwork:

- Job 6. Make-ready for mixed forms, including use of spot sheet and hard and soft packing.
- Job 7. Lock-up of a letterhead form.

Tests: Covering definition of terms, measurement problem, grammar, and casting off problem.

Assignment XII

Information:

- Job 1. Figuring paper.
- Job 2. Shop routine.

Library and Homework:

- Job 3. Define riding; cabinet; letterboard; proof planer; shooting stick; mitering machine; blanket; letterpress; make-up rule; reglet; hell box; kick; slur; tack; side stick.

Shopwork:

- Job 4. Tabular composition. Set double column of figures.
- Job 5. Lay out list of names and addresses to be set in tabular form.
- Job 6. Set Job 5.

Tests: Covering definition of terms, casting off problem, double and triple cap case layout (uses), and punctuation.

Assignment XIII

Information:

- Job 1. Metal furniture case.
- Job 2. Layout of special cases, space and quad, Jankee job, news cases, fraction case, sort cases, etc.

Library and Homework:

- Job 3. Define brass rule; beard; copper spaces; border; hair spaces; logotype; form truck; job font; corner quads; sorts; column rule; letter; open spacing; boxes; parallel rules.

Shopwork:

- Job 4. Lock up four pages in two 2-page forms to be printed sheetwise. Figure margins.
- Job 5. Set inside of program from one font of type.
- Job 6. Set blank form with rule lines one way only.

Tests: Covering definition of terms, measurement problem, casting off space problem, paper problem, shop routine.

Assignment XIV

Information:

- Job 1. Imposing forms of eight pages and less for hand folding.

Library and Homework:

- Job 2. Define machine finish; feet; black line; fractions; beveled furniture; quire; dotted rule; bundle; calendar; unlead; blocks; braces; waste; C.&S.C.

Shopwork:

- Job 3. Set box from rule.
- Job 4. Set double box from rule.

Job 5. Set overlapping boxes from rule.

Job 6. Set simple panel from rule.

Job 7. Set complex panel.

Job 8. Lock-up for accordion fold.

Tests: Covering definition of terms, casting off problem, paper problem, identification of type face, shop routine.

Assignment XV

Information:

Job 1. Imposing forms of eight pages or less for machine folding.

Library and Homework:

Job 2. Define keep standing; bad copy; live copy; press revise; style sheet; all out; live matter; all up; all in hand; casting off; forms closed; kill; column wide; dead matter; straight matter.

Shopwork:

Job 3. Set rule border around form.

Job 4. Set cast font border around form.

Job 5. Cut stock for Job 4.

Job 6. Set statement or other rule form to be run work and twist.

Tests: Covering definition of terms, paper problems, imposition problems, use of special cases, shop routine.

Assignment XVI

Information:

Job 1. Order of procedure in book.

Job 2. Kinds of presses and their uses.

Library and Homework:

Job 3. Define stone man; rule work; composing room; bond; wove paper; run over; coated paper; stock; watermark; ornament; style; enameled; stonework; panel; open matter.

Shopwork:

Job 4. Set a title-page using one font of type.

Job 5. Change Job 4; set author's name in italic type of same size.

Job 6. Set motto card with initial border—two color.

Job 7. Register and print Job 6.

Tests: Covering definition of terms, space and type problem, book procedure, uses of various kinds of presses, shop routine.

Assignment XVII

Information:

Job 1. Color harmony and application.

Job 2. Power in the printshop and its transmission by belts and pulleys. How to figure speed and power.

Library and Homework:

Job 3. Define tailpiece; credit line; straightedge; caption; dummy; catch line; bookwork; book stamp; book office; footnote; bastard title; appendix; proof dummy; binder's title; cut-in note.

Shopwork:

Job 4. Design cover page for program in two colors.

Job 5. Set and print Job 4.

Job 6. Design and lay out a dodger.

Job 7. Set and print Job 6.

Tests: Covering definition of terms, paper problems, lay-out problems, power transmission problem.

Assignment XVIII

Information:

Job 1. Auxiliary apparatus in the printshop. Folders, feeders, static elimination, mitering machines, cutters, etc.

Job 2. Composing machines.

Library and Homework:

Job 3. Define antimony; lead; copper; tin; intaglio; kern; "30," pull out; squeeze away; rule border; tumble form; pickup; make-up; take; standing matter.

Shopwork:

Job 4. Lay out a plain admission ticket.

Job 5. Set Job 4.

Job 6. Lay out a ticket with ornamental rule border.

Job 7. Set Job 6.

Job 8. Lay out ticket with stub.

Job 9. Set job 8.

Tests: Covering definition of terms, power problem, paper problem, imposition problem, shop routine, use of auxiliary apparatus.

Assignment XIX

Information:

Job 1. Engraving, electrotyping, etching and casting processes (stereotypes).

Library and Homework:

Job 2. Define reducer; opaque; varnish; dope; drier; pick; phat; color work; dagger; accent; asterisk; circumflex; bar; quotation; height to paper.

Shopwork:

Job 3. Design and lay out booklet cover using color and cuts.

Job 4. Set Job 3.

Job 5. Design and lay out program cover using background of cast font border.

Job 6. Set Job 5.

Tests: Covering definitions of terms, engraving and plates, composing machines.

Assignment XX

Information:

Job 1. Printing-trade customs; commercial.

Job 2. Things a printer should know; Roman numerals, Greek letters, etc.

Library and Homework:

Job 3. Define reader; feeder; low to paper; back up; fenders; underlay; offset; make-ready; margins; frisket; overlay; bleed; packing; work and turn; make-ready knife.

Shopwork:

Job 4. Lay out and set content for Job 5 (*Assignment XIX*).

Job 5. Cut stock and print above program, key forms work and turn.

Job 6. Print in color and cut.

Test: Covering definition of terms, trade customs, Roman numerals, composition problem involving both ems and copy, paper problem, power problem, imposition problem.

Assignment XXI

Information:

Job 1. Imposing forms of over eight pages for hand folding.

Job 2. Styles of blank forms used in connection with hand and mechanical accounting systems.

Library and Homework:

Job 3. Define canceled figures; cock and hens; double dagger; double rule; foundry chase; cylinder press; foundry proof; fist; foundry forms; line of stars; mitered corners; mold; mortise; perforating rule; inferior letters or figures.

Shopwork:

Job 4. Lay out, set, and print a ruled billhead. Get approval of your plan before starting.

Tests: Covering definition of terms. Set panel form suitable for time available.

Assignment XXII

Information:

Job 1. Imposing forms of over eight pages for machine folding.

Job 2. Composition of advertisements.

Library and Homework:

Job 3. Define lining type; wood type; swash letters; stereotype chase; railroad furniture; quotation furniture; piece fractions; imprint; embossing; creasing; bronzing; series; sort case; rate card; embossing press.

Shopwork:

Job 4. Lay out an invoice form to be used on typewriter. Set and print.

Tests: Covering definition of terms, imposition for accordion folder.

Assignment XXIII

Information:

Job 1. Breaking and imposing rule forms for work and twist.

Library and Homework:

Job 2. Define side stitched; skeletonized; slip-sheeting;

picking sorts; perfecting press; melting pot; key form; perforating; size; sheetwise; scoring; perfecting; matrices; linotype; saddle stitching.

Shopwork:

Job 3. Lay out a statement suitable for use in connection with a machine bookkeeping system. Get O.K. and set.

Tests: Covering definition of terms and casting off space. Set small advertisement from rough layout furnished.

Assignment XXIV

Information:

Job 1. Identifying characters of old style, transitional, and modern type faces.

Job 2. Composition and care of printing rollers.

Library and Homework:

Job 3. Define lithography; line engraving; key plate; halftone; engraving; electrotype; type caster; electro; duotone; duotype; duograph; burr; backing; slitting; Ben Day process.

Shopwork:

Job 4. Lay out a banquet menu from the copy furnished. Set and get O.K.

Tests: Covering definition of current weeks terms. Make layout for eight page work and turn forms.

Assignment XXV

Information:

Job 1. Proportion in printing, including the printer's oblong, the golden oblong, the regular oblong and the hypotenuse oblong.

Job 2. Division of space and balance in the oblong, including a study of margins.

Library and Homework:

Job 3. Define retouching; routing; zinc engraving; wax engraving; process work; photo-engraving; off-set printing; cast; stipple; stereotype; ratchet; plate; monotone; monotype; stereotype flog.

Shopwork:

Job 4. Design and lay out an appropriate cover for graduation issue of the school paper.

Job 5. Set Job 4 and submit proof to instructor.

Tests: Covering definition of terms and identification of type faces as to old style, transitional, or modern.

Assignment XXVI

Information:

Job 1. Paper and paper making—historical.

Job 2. Modern methods and material of paper making.

Library and Homework:

Job 3. Define vellum; parchment; brochure; pulp; broadside; billhead; poster stick; letterhead; poster type; poster; wood engraving; woodcut; wash drawing; vignette; pull-out folder.

Shopwork:

Job 4. Make plans and layouts for a uniform system of typography for the school paper. Include headlines.

Job 5. From your plans above, prepare a chart such as the editor might use as a guide in preparing copy.

Tests: Covering definition of terms, identification of pieces of type as to family, definition or illustration of the four oblongs.

Assignment XXVII

Information:

Job 1. Raised-letter process of printing.

Job 2. Copper and steel-plate engraving.

Library and Homework:

Job 3. Define advertising agent; advertising solicitor; full position; advance sheets; author's alterations; author's corrections; deckle edge; reprint; display; misprint; point-set; excerpt; errata; scrap; egg-shell finish.

Shopwork:

Job 4. Make-up pages for school paper from dummy. Get O.K. from editor.

Job 5. Impose and lock up above pages two up.

Tests: Covering definition of terms and questions on paper making.

Assignment XXVIII

Information:

Job 1. Correct form for social printing.

Library and Homework:

Job 2. Define abbreviations: ad.; adv.; p.; pp.; N.R.-M.; MS.; MSS.; recto; Ed.; ed; sub; t.a.w.; tc.; t.c.n.r.m.; w.; eod.

Shopwork:

Job 3. Gather data for a faculty directory or other booklet as assigned by instructor.

Job 4. Edit the information you have procured and make a layout; layout a cover.

Tests: Covering definition of terms and differentiation between raised letter printing and copper and steel plate engraving.

Assignment XXIX

Information:

Job 1. Creasing, embossing, perforating and punching.

Library and Homework:

Job 2. Define end sheets; signature; casing; book chase; ungathered; signature mark; white page; fly; contents; index; leaf; sinkage; title-page; verso; edition de luxe.

Shopwork:

Job 3. Set, impose, lock up, and print the number of copies of the booklet (Assignment XXVIII) ordered by instructor.

Tests: Covering definition of terms, identification of type faces, margins and balance.

Assignment XXX

Information:

Job 1. Sources of printing information and how to find out about processes and practices.

Library and Homework:

Job 2. Define short take; short page; running title; running head; semiweekly; flyleaf; half-title; lean; run in; paging; biweekly; bimonthly; semimonthly; gathering; marginal notes.

Shopwork:

Job 3. Fold, bind, and trim the booklet you have just printed.

Tests: Covering definition of terms, special processes, imposition, problems.

COURSE OF STUDY IN HOUSEHOLD MECHANICS FOR THE EIGHTH GRADE

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I. Time Allotment

One hour a day, five days a week, for 36 weeks.

II. Objectives.

To train the boy for worthy home membership.

To develop the ability to make simple repairs in the home.

To develop an appreciation of the use and care of tools.

To develop habits of thrift and interest in keeping things in good repair.

To teach the boy to be useful by developing confidence in his ability to plan and execute necessary repairs around the home.

III. Outline of Course

The course is broken down into typical fields. Certain jobs are done and information is given, so

that the student will acquire the desired skill and knowledge in each of the fields.

Suggested jobs are listed in each field.

These particular jobs are listed because they are typical and because they have proved to be the most satisfactory.

Sometimes it is advisable to substitute different jobs to fit individual cases.

Suggested lessons are shown to give an idea of the information that is covered in the course.

I. *Woodwork*

- A. Repairing of toys.
- B. Repairing of furniture.
 1. Repair a piece of furniture in which a broken part is missing.
 2. Repair a piece of furniture in which joints are loose.
 3. Repair or adjust a drawer.
 4. Recane a chair bottom.
 5. Repair or replace upholstery.
- C. Design and make a simple problem such as might be needed in the home.
 1. Shelf.
 2. Combination kitchen stool and ladder.
 3. Trellis.
- D. Finishing and refinishing.
 1. Study paint, its ingredients and how to mix colors.
 2. Applying paint to furniture.
 3. Study stains, how made, how applied.
 4. Study shellac and its application.
 5. Study fillers, their uses.
 6. Study varnishes and how to apply.
 7. Study varnish removers and make some.
 8. Refinish an old piece of furniture, not very large.
- E. Woodworking tools.
 1. The study of these is taken up a tool at a time as each lesson may require the use of that tool.
 2. Sharpening woodworking tools.
- F. Some time taken incidentally for study of woods and their fitness for furniture repair.

II. *Garden tools*

- A. Care and use.
- B. Sharpen and adjust a lawn mower.

III. *Electrical Repair*

- A. Wiring.
 1. Splices.
 2. Switches.
 3. Connections.
- B. Apparatus.
 1. Transformers and induction coils.
 2. Batteries, parallel and series connecting.
 3. Lights, running circuits.
 4. Bells, problems involving one bell and several switches and one switch for several bells.
 5. Fuses.
- C. Locating trouble.
 1. Lighting system.
 - a) Switches, poor connections.
 - b) Bulb, broken filament.
 - c) Broken lead wire.
 - d) Faulty socket.
 - e) Short circuit, poor insulation.
 - f) Burned-out fuse.
 - g) Faulty rosette.
 2. Heating devices.
 - a) Broken element wire.
 - b) Short circuit within.
 3. Bells.
 - a) Faulty transformer or battery.
 - b) Faulty adjustment of gap.
 - c) Broken vibrator spring.
 - d) Broken armature.
 - e) Bad contact points.
- D. Radio
 1. Principles involved.

2. Parts of set.

- a) Aerial.
- b) Detector.
- c) Condenser.

d) Current.

e) Phones

IV. *Concrete*

- A. Concrete and its uses.
 1. Definition.
 2. Range of uses.
 3. Opportunities in field.
 4. Brief description of materials and tools used.
- B. Principles of form construction.
 1. Types.
 2. Planning.
 3. Kinds of wood to use.
 4. Preparing forms.
 5. Cleaning forms.
- C. Cement.
 1. History and development.
 2. Manufacture.
 3. Storage and handling.
 4. Specifications and tests.
- D. Concrete aggregates.
 1. Definition of sand and pebbles.
 2. Testing of aggregate.
 3. Study of local material.
- E. Proportioning and mixing concrete.
 1. Principles of proportioning.
 2. Recommended mixing.
 3. Water.
 4. Hand mixing.
 5. Machine mixing.
 6. Speed and time of mixing.
- F. Placing concrete and protecting during hardening period.
 1. Tamping and spading.
 2. Vibrating forms.
 3. Principles involved in hardening action.
 4. Methods of protection while hardening.
 5. Concreting in cold weather.
- G. Simple reinforcing principles.
- H. Surface finishes.
 1. Variety of finishes possible.
 - a) Floated.
 - b) Tooled.
 - c) Scrubbed and polished.
 2. Use of special aggregates.
 3. Use of color pigments.
 4. Coloring by immersion.
 5. Stucco finish.
- I. Suggested projects.
 1. Home plate for baseball diamond.
 2. Tea-pot stand.
 3. Flower box.
 4. Dish for bulbs.
 5. Lawn pedestal.

V. *Carpentry*

- A. A study of:
 1. Sills.
 2. Joists.
 3. Studs.
 4. Rafters.
 5. Sheathing.
 6. Subfloor.
 7. Finish floor.
 8. Parts of a door.
 9. Parts of a window.

VI. *Soldering and Sheet-Metal Work*

- A. Tin a soldering copper.
- B. Repair, by soldering, kitchen utensils.
- C. Construct small articles of tin.
 1. Cooky cutter.
 2. Match box.
 3. Milk-bottle holder.
 4. Cup.

VII. *Glass and Glazing*

- A. Make some putty.
- B. Cut glass to size and shape.
- C. Glaze a sash.

VIII. *Plumbing*

- A. Read a water meter.
- B. Shut off water draining all pipes.
- C. Thaw out frozen pipes.
- D. Purify drinking water.
- E. Clean a drain trap.
- F. Study parts of flush tank.

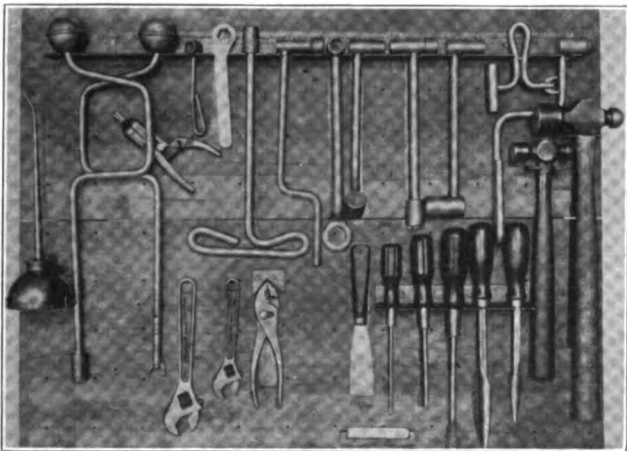
Care of Equipment and Supplies

CARING FOR HAND TOOLS IN THE AUTOSHOP

Ray F. Kuns, Principal Automotive Trades School,
Cincinnati, Ohio

Conditions within the automobile shop with respect to tool care, are somewhat different from those which would be used in the old-line woodshop. In the first place, the automobile work does not lend itself to easiness of bench and tool arrangement. The work is done on the bench in a small percentage of cases. Students cannot be confined to a certain bench or spot in the room, and they are frequently out of sight in or under a car.

Perhaps the best system of keeping track of tools (being used within the room) and knowing that they are returned, is the good old-fashioned check system. Many schools have tried the check system, and it has been criticized freely. In some of these schools, each student is given a ring on which are five or more checks bearing his number. The difficulty usually experienced where this is done is that another check system is required to keep track of the checks. Boys will place the check rings in their pocket and leave the room, or they forget to bring them with them to school, etc. Some schools make use of the check board, which is nothing more than a board with about 25 pins, each pin having five brass checks; or the checks may be mounted five in a row, with 25 rows, so that a glance at the board shows the loss of a check, which means that some tool has not been returned. The writer believes the most satisfactory method is one similar to this. The checks are always on hand, and if the checks are properly checked up at the end of the lesson period,



A TOOL PANEL MAY BE ARRANGED OVER THE BENCH OR IN THE TOOL CRIB

the tools are also sure to be checked. Usually boys take turns serving in the toolroom.

The toolroom itself may be nothing more than a corner of the shop, or it may even be tool panels above certain portions of the bench, or tool panels on the wall. Students may be trained to deposit their own checks on the pin at the time they remove the tool, in this way doing away with the necessity of having one boy give his time to the toolroom. On the other hand, the toolroom lesson is a very valuable one, and the time is not lost, so far as training is concerned.

Experience would seem to indicate that it is almost impossible to keep track of tools in the auto-shop, unless each tool is provided with a place where it may readily be seen at a glance. This automatically does away with the storing of tools in lockers or drawers. Of course, this does not mean that in no instances are tools to be stored in tool lockers, but this latter would likely be the case only where special tools or other items that are not used extensively, are to be kept.

A very serviceable tool panel could be made of sheet steel $\frac{1}{8}$ -in. thick, with holes tapped into it for the pins which are to hold the tools, and with the edge reinforced with $\frac{1}{8}$ by 1-in. equal-leg angle iron. This would be an improvement over the tool panel shown in Figure 1, which was made of poplar wood, which in drying out, developed the crack shown in the illustration.

Precision tools, such as rules, micrometer, caliper, etc., may be kept in a case having a glass door, so that a glance will suffice to show whether or not any tools are missing. Of course, such a case should be provided with a lock.

In some schools the practice is to have tools made up in kits, each kit being contained in a metal box. A certain kit of tools is used to do a certain job of work, say for instance, overhauling a rear axle. When the workman gets his instructions from the teacher, he is given with the instruction sheet, a check entitling him to the proper tool kit, and then proceeds with his work. When the tools are returned, the tool man checks the kit for the complete layout of tools. This method requires a greater assortment of tools, and while it does save some time, less judgment need be exercised by the student.

Lending Tools. Tools should never be lent within the building, except upon written request of the instructor or teacher. The note requesting the lend-

ing of tools should be on file. When the tools are returned, the note should be returned to the original writer.

When tools are lent outside of the building, it should only be done upon a deposit of money, equaling the approximate price of the tools. It is not a question of trustworthiness of those applying for the tools; it is just a question of protecting the rights of the taxpayers. Some boards of education have rules prohibiting the lending of tools under any conditions.

Taking Inventory. In many cities this is controlled by a regular inventory date set by the business department of the board of education. When not so controlled, possibly the best time for the inventory would be at the time the tools are checked up preparatory for storing them for the summer-vacation period. At this time, any tools which have become broken, and are beyond repair, should be discarded and requisitions should be issued for tools to replace them. In many cities, vacation period is the time set aside for this type of work. Considerable time is saved if an inventory card is prepared and printed by the school press or run off on the mimeograph. This should be a simple card on which a line is provided for the name of the tool, its trade name, the manufacturer thereof, and its trade or catalog number. One tool only is to be listed on each card. This makes reordering easy. These inventory cards should have columns for about ten years, so that the condition of the tool from year to year, and the amount on hand, can easily be checked. These cards should also have a column in which is to be recorded when a tool is lost or broken, and when it is replaced, and where the charge is to be made. The inventory card should be in the toolroom, so that the card can be referred to for the number of tools on hand and their actual condition. These cards will help to show the wear and tear on tools, and give the instructor an intimation of when and in what quantities he is to reorder certain items.

Sharpening and Conditioning Tools. The instructor in the autoshop is certain to be busy maintaining his equipment, and will be pressed for time in which to maintain hand tools. Generally speaking, the best thing to do with a tool which has become broken is to discard it and replace it with a new one. Hammer handles are broken, and must be replaced. Chisels and punches become dull and must be re-forged. Bearing scrapers become dull continuously, and these must be sharpened by the workman using them. As much as possible of the tool reconditioning should go outside the shop. Punches and chisels may be forged by the students in other departments, if they have time.

Storing the Tools for Vacation. Ordinarily, by the time vacation arrives, the automobile shop tools are so thoroughly impregnated with grease that little

need be done outside of seeing that they are dry, and stored in a dry place for the summer. Cosmoline, cup grease, or 600-W, may be used liberally in storing the tools, if it is felt that further protection is needed.

Since the automobile tools are those which can be made use of by anyone who may have access to them, it is a very good plan to have the tools stored in cabinets and then the key left with the principal of the school. In some instances the toolroom may be locked with a padlock, and the key left with the principal or director of the department.

Surplus Supplies. Grease, oils, paints, brake lining, cotter pins, wood screws, machine screws, rivets, lighting wire and bulbs, spark plugs, and similar items, have an almost universal appeal to those who may pass, and for that reason also should be stored in some place where they are fully protected by lock. In most autoshops the toolroom and the stockroom are combined in one. If a special room can be set off for the supplies, it makes a more ideal arrangement. However, it should be close to the toolroom, so that the toolroom caretaker also may have charge of the supplies.

CARE AND STORAGE OF INSTRUMENTS AND SUPPLIES IN THE DRAFTING ROOM

W. A. De Vette, Wilson Junior High School,
Erie, Pennsylvania

In the school drawing room, as in the school shop, equipment and supplies must be issued to each student at the beginning of every class period. Likewise, all the equipment must necessarily be checked at the end of each period. This continual issuing and constant checking presents quite a problem.

The simplest solution to this problem is one which must be made at the time the room furnishings are selected. In considering the selection of furnishings and equipment, it must be understood that there are certain articles which each student uses every class period and others which are used only occasionally, and then only by one or two students at a time.

In the first group are included sets of instruments, triangles, scales, pencils, erasers, and file and tack lifters. There is also a T square, but this is best left at the desk permanently while the rest must be issued and checked each period.

In the second group must be included such equipment as irregular curves, beam compass, shears, calipers, handbooks, reference books, etc.

Individual Equipment

To take care of issuing and checking of each student's equipment, a cabinet similar to the one shown in Figure 1, should be selected. It serves its purpose best when it is placed near the door as



FIG. 1

shown at 3 in Figure 2. The upper part consists of an individual drawer for each student bench in the classroom. In each of these drawers are placed a complete set of tools, and such other equipment as the instructor may wish to include. Figure 3

In classrooms where very elementary work is carried on, all the equipment is sometimes placed in blocks and is at all times in view of the instructor, but the responsibility for the condition of any particular compass or other article cannot be fixed, and hence, this system cannot be considered so very satisfactory.

General Equipment

The equipment intended for general use in the drafting room is not so extensive as to warrant a checking system. A cabinet, preferably one having glass doors, may be placed next to the instrument cabinet, as shown at 4 in Figure 2. In this case, each item of general equipment may be given a place. In most instances its outline may be traced against the back so the place for each may be readily located. After checking up the individual drawers the instructor can glance into the case and instantly satisfy himself that everything is in shape.

At the close of the day the case may be locked, while the instrument drawers are held in place by bar and padlock, as is indicated in Figure 1, or by locking a door over them.

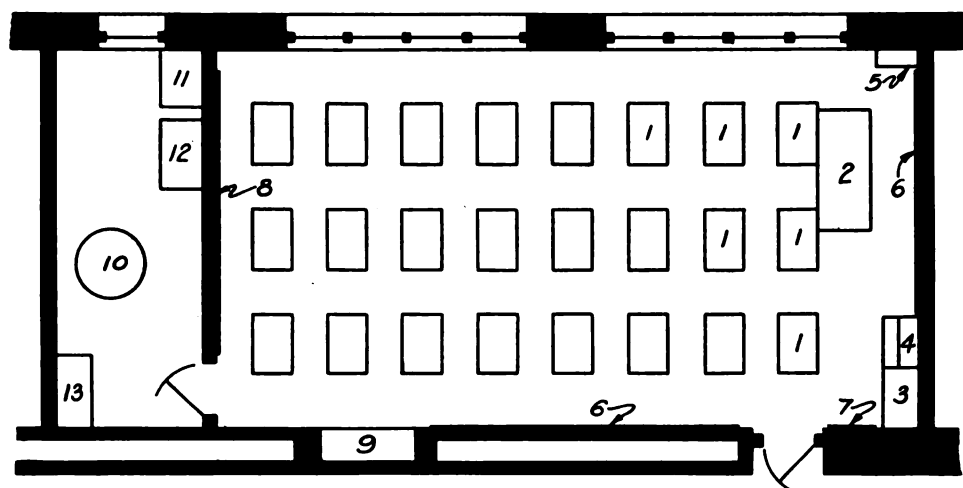


FIG. 2

shows an arrangement which has been found quite satisfactory.

Each student, upon entering the room, takes the drawer corresponding in number to that of his desk, examines the contents to see if anything is missing, and if so, immediately reports to the instructor. By taking the drawer to his bench the student assumes the responsibility for everything being in good condition. At the close of the period the instructor takes his position at a point where all the students must pass him on their way to the cabinet. He can thus see at a glance that everything is in its proper place in the drawer. Should he overlook any article, the next student using the drawer will report to him at the beginning of the next class and the instructor can immediately fix the responsibility.

Inventory

Inventory in a school drawing room, while not a very arduous undertaking, should be necessary only twice a year. At the time of preparing the budget

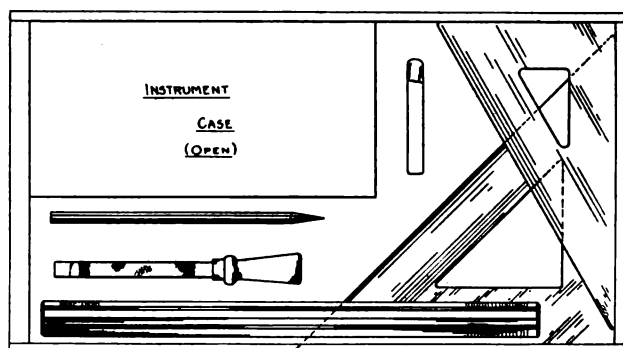


FIG. 3

for a new school year, an inventory is necessary to check the amount of supplies that has been used, and equipment which must be replaced in estimating the needs for the following year. At the end of the school year there must, of course, be an inventory of equipment and supplies which may be checked by the instructor after the summer vacation is over.

Conditioning Instruments

Drawing instruments require very little adjusting, with the exception of lead and needle points which each student must do while working. To prevent students needlessly tampering with the compass joints, etc., it is well for the instructor to remove all screw drivers from the instrument cases and acquaint all students with the reason for the vacant place in the set. No students, aside from the technical or drafting trade classes, should be allowed to adjust instruments or to sharpen ruling pens or ink compasses. As a rule, this work will be done by the instructor during vacant periods or after school hours. The technical classes mentioned should be taught how to do this as a regular part of their class instruction, and thereafter they should be allowed to do this work under the direct supervision of the instructor.

Storage During Vacation

It is, of course, unnecessary to slush instruments in the same way as shop machinery for the vacation period. It is sufficient if each instrument is wiped with a piece of cloth saturated with machine oil and replaced in the case. Beam compass, calipers, etc., may be left wrapped in slightly oily pieces of cloth and boxed.

Surplus Supplies

All supplies left at the end of the year should be listed and placed, together with a duplicate list, in the general stockroom of the school. A copy of this list, together with the inventory, should be filed in the office.

At the beginning of the new school year all old equipment, new equipment, and supplies must be checked to find any possible discrepancy between the supplies asked for and received. Then any necessary adjustment in the courses may be made at the beginning rather than when supplies begin to run low.

CARE AND DISTRIBUTION OF TOOLS AND SUPPLIES IN A SHEET-METAL SCHOOL SHOP

Charles H. Derby, Academy High School,
Erie, Pennsylvania

Every school shop experiences some loss of tools between the opening of school in September and the closing day in June. To reduce this loss to a minimum, several systems of distribution and

checking have been evolved. None of these systems is worth much unless faithfully administered.

In some shops we will find a drawer for each bench. Each drawer contains the ordinary hand tools needed by the sheet-metal worker on most jobs; namely, hammer, snips, pliers, scratch awl, two or three sizes of punches, pair of dividers, a couple of rivet sets, and a soldering copper.

If such is the case, there should be a metal-bound card on which is a list of the tools to be found in that drawer. This card may be kept in the drawer, or better, hung under the bench. The bench, the card, and each tool in the drawer, should bear the same number.

The first thing the boy should do after taking his place at the bench to which he has been assigned is to make an inventory of the tools and compare it with the list on the card. If any are missing, he should report the same to the instructor at once. The instructor then holds the last one using the bench responsible for the missing tool. In order to do this there must be a lock on each drawer, the key being given out by the instructor at the beginning of the class period and returned to him at the close of the period.

This same method of checking up by use of a list for each bench, may be used if the tools are in plain sight on the bench or in a rack at the end or over the bench, as they are in some shops.

This method has its drawbacks as is the case with every method, but almost any system is better than no system. One drawback to the bench-drawer method is that the instructor must check each drawer himself or appoint someone to do it, or he will not know of any shortage until the next class comes in and reports the fact, in which case he will have to send to another room for the boy responsible for the loss.

Extra tools and supplies are kept in a toolroom and given out by the instructor as needed.

Another and perhaps better system is to have all tools and supplies kept in a toolroom with each tool hung on the wall in plain sight, and each tool and its position on the wall bearing the same number. Over the instructor's desk, or in some handy place on the wall, are twenty hooks numbered from 1 to 20, and on each hook is a key ring with six metal disks $\frac{3}{4}$ to 1 in. in diameter, each one of which bears the same number as the hook on which it hangs.

As the class enters, the instructor gives each boy a ring of the checks numbered the same as his number on the class book. A boy is then appointed to check out the tools as they are called for. When a boy asks for a tool, he takes a metal check off his ring and this is hung in the place from which the tool is taken. When the tool is returned, the check is returned to the boy. In this way either a check

or the tool is always in position on the wall, and the instructor can tell at a glance if all the tools are where they belong or who is responsible for any that may be out.

It is not necessary to keep a boy in the toolroom after the tools are given out until time to check the tools in. The instructor will be able to give out the extra tools as needed.

A variation of this system might be to have printed requisition slips to be filled out and signed by the boy wishing the tool. The slip is then placed where the tool was taken from and destroyed when the tool is returned. All things considered, probably the best system is the one with the metal checks.

Keeping the tools and machines in condition is a duty often neglected. This is very important and should be considered as much a part of the trade boy's education as the development of the skills of the trade. Every movable joint in a tool or machine needs oiling and the trade boy should know when this needs to be done and how much oil is to be used. He should know how to draw out a soldering copper for different uses, how to sharpen a scratch awl, a cold chisel, a screw driver, a drill, or a pair of snips, and how to put a handle in a hammer so that the head will hang properly and not work loose. There is no better time for him to learn all this than right on the job when it needs to be done.

A general conditioning of tools and machines should be started about two weeks before closing school for the summer vacation, and just before closing, all the tools and machines that are liable to rust during the vacation should be covered lightly with a good cup grease.

All supplies should be stored in the toolroom which might be called a combination toolroom, office, and stockroom. Supplies should be given out only by the instructor or on his order. A cupboard should be provided for solder, sal ammoniac, fluxes, rivets, stove bolts, and all small supplies; also the reserve tools, such as files, screw drivers, cold chisels, rules, hack-saw blades, and repairs for tools, as hammer handles, soldering-iron handles, extra bolts for snips, etc.

A good way to take care of the coils of wire is to hang them on bars of iron or pieces of $\frac{1}{2}$ -in. pipe driven into holes bored in the studding about 32 in. above the floor.

A rack with six shelves 32 or 38 in. wide, and 103 in. long with about 6 in. between shelves, and starting 6 in. above the floor will provide good storage for sheet iron and tin. Other supplies, as copper, zinc, angle iron, band iron, etc., may be kept on top of these shelves or on shelves or racks built above them for that purpose.

When the sheet iron is placed in the rack the first sheet should be numbered 1 with a crayon or colored pencil and each sheet numbered as it is placed. A glance at the top sheet will show at any time just how many sheets are left on that shelf which is quite a saving of time and labor when this information is needed.

THE STORAGE AND CARE OF ELECTRICAL TOOLS AND SUPPLIES

E. W. Jones, Kansas State Teachers College,
Pittsburg, Kansas

Good tools, and the right kind of tools, are essential to good work. Tools are made to use, even to wear out and to break occasionally, but there is no justification for handling them roughly, losing them or neglecting them. Since a considerable portion of the expense in shop operation lies in the cost and upkeep of tools, a workable system of care and storage should be the aim of every shop teacher.

In the larger shops, and in many small ones also, a toolroom is employed for the storage of tools. The tools are checked out at the beginning of the class period and checked in again at the close. Each boy takes his turn at the checking job for a definite period of time. Sufficient space is provided on the rack or shelf for all the tools in daily use, and each tool has its appointed place. This place may be numbered to correspond with the number stamped on the tool, the numbers being as large and as conspicuous as possible. The practice of gluing a catalog picture of the tool in place behind the tool is followed by some. Visual helps such as these are quite necessary where small boys are expected to check the tools and keep the toolroom in order. Also a color scheme of marking the tools of each shop is quite common. Under this plan one shop in a school will paint or lacquer on each tool a bright spot or band of a chosen color—blue, for example. Another shop will use red, another yellow or gray or white, until every shop has its distinguishing color mark. In this way a strayed or borrowed tool is easily identified.

For the checking of tools from the toolroom, a system of metal checks has been much used. Each student has an assigned number, which appears on all the checks issued to him. When he exchanges a check for a tool, the check is hung on a hook at the spot where the tool was removed. When the tool is returned, the student is given back his check. This plan has some advantages, such as simplicity and speed, but the loss of checks, mistakes by the toolroom boy, and other disadvantages, have caused it to be discarded in many places.

In its stead, some have found the ticket system preferable. On a small, printed slip of paper, carrying the shop's name and a date line, the student

lists the tools he wants and signs his name at the bottom. The toolroom boy hangs this list on a hook board, on which the hooks are lettered alphabetically. When the tools are returned they are checked off by the toolroom boy in the presence of the student who signed for them, the ticket being then destroyed. Thus mistakes are minimized and loss of tools prevented.

There are other checking systems in use as well as variations of those described above. Some are satisfactory, others may be much improved. The efficiency of the system employed depends less on the kind of system than on its consistent practice. Close attention by the teacher and a right attitude on the part of the students are essential to success. Instruction in the care and use of tools, which should be a part of every shop course, may be made to go far in building up proper respect for good tools and pride in their care and storage. The teacher's presentation of the matter may even make the toolroom boy's job one of importance and desirability, as it may well be, or he can allow it to remain a task to be dreaded and avoided. The student's attitude is largely in the teacher's hands.

In some shops only the general tools are kept in the toolroom. The smaller, individual tools, such as pliers, screw drivers, etc., are assigned to the student, with or without deposit, at the beginning of the semester and are stored in a locked cabinet or drawer at the student's bench. This considerably simplifies the problem of tool checking and saves time. In many smaller shops the practice of keeping all general tools on the bench top in full sight is still followed. This method has some advantages but leaves the tools subject to theft and to

use by unauthorized persons, which may lead to considerable loss.

The improved form of wall tool cabinet, shown in Figure 1, is now coming into use for general tools, and may supersede the method of storing tools on the bench or even in the toolroom. This cabinet is built against the wall out in the shop where the students may have access to it, with or without a checking system. Each tool should have its own place in this cabinet on hook, shelf, or rack, and that place should be plainly marked. Also the color code for identifying each shop's tools may be employed.

The dimensions of the cabinet may be altered to suit the wall space available, or the size, number and shape of tools that are to be placed in it. Both doors, as well as the back of the cabinet, are used to carry tools. A hasp and padlock serve to lock the cabinet. The lumber used in making it, as well as the finish, may be anything desired, but quality should not be sacrificed.

Where keys are issued to students for individual drawers, a form of key cabinet much liked by those who have used it, is shown in Figure 2. When a class enters, the proper keyboard is taken out, the cabinet is locked and the keyboard hung on the large hook on the front of the door. When the classes again change, the first board is returned to its place, another is hung out and the cabinet is again locked.

The sharpening and minor repairing of the simpler tools should be done by the students, as occasion arises, under the supervision of the teacher. The close of the semester should be a time for putting all tools in good order. Major

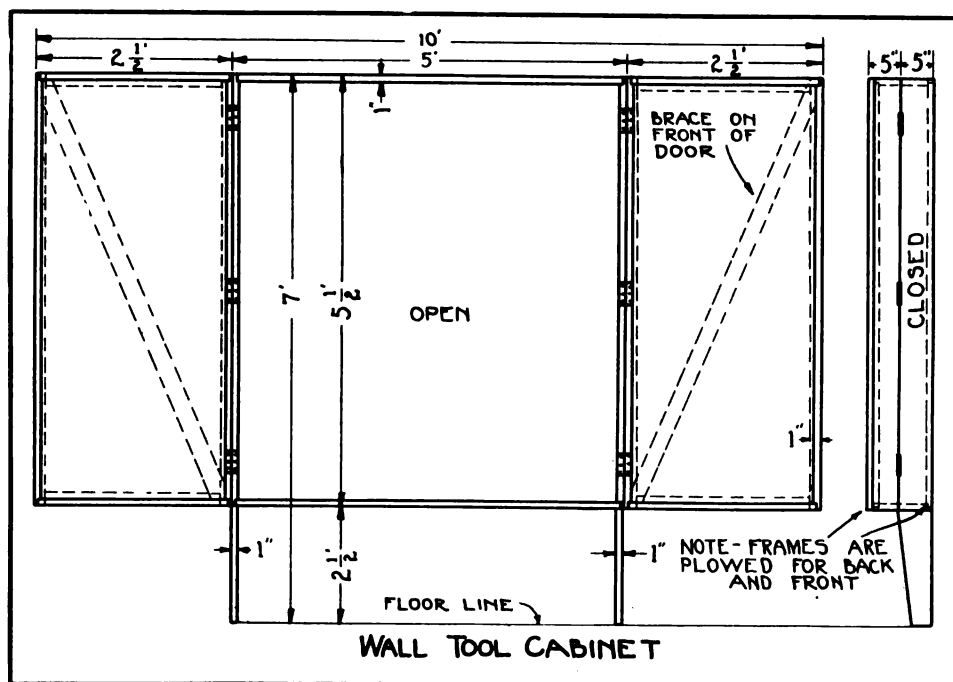


FIG. 1

repairs and the conditioning of the more complicated tools are better done by the repair department of the school system or sent to outside firms.

The storage of tools during the summer vacation is important and should receive due attention. The toolroom should be free of roof and window leaks and other forms of dampness. To avoid rusting,

Meters thus reconditioned will be as reliable as ever.

The care of surplus supplies is mostly a matter of storage. In general, they should be kept apart from the tools and materials that are used daily. Locked cabinets, either in the toolroom or in the shop, accessible, in most cases, only to the instruc-

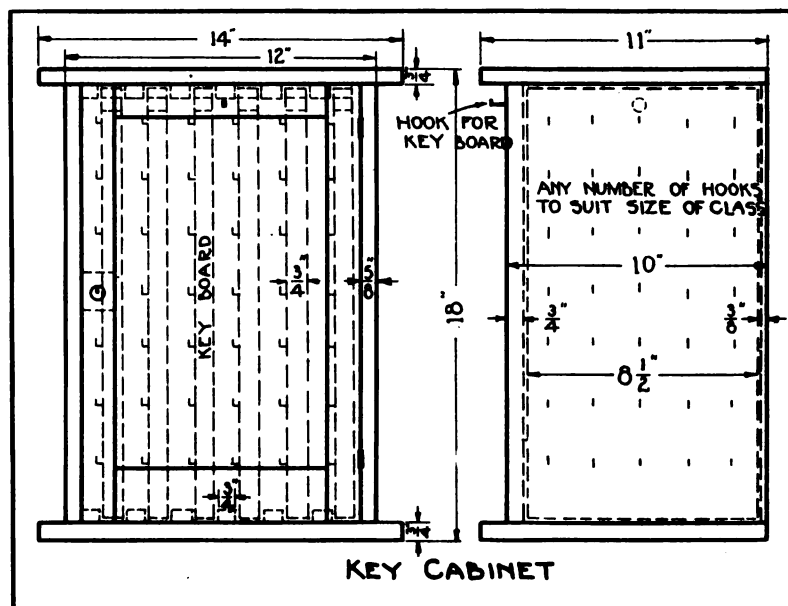


FIG. 2

all steel parts should be well greased, after the conditioning of the tools at the close of the semester has been done. For removing the grease, when school begins again, kerosene is recommended as the safest solvent. It is well to have both the greasing and the cleaning of tools performed by the students as a part of classwork, since an important lesson is involved. The toolroom should be locked during the vacation period, as a matter of course.

Since electric meters and other demonstrating and testing apparatus usually make up an extensive part of electrical-shop equipment, their care and storage must not be neglected. Locked wall cases, or a separate portion of the toolroom should be provided for their protection. The usual system of checking tools that is in use in the shop should be followed in checking out the instruments. When meters are in use, the students should be instructed never to apply voltage to a circuit until he has obtained the teacher's approval of the connections of the circuit, as there is great danger that expensive damage may be done to the instruments almost instantly. When such instructions are followed, the school usually pays for damage done to meters in line of work. As meter repairing generally requires special skill and special materials, such repairs should be made at the factory, where the meter's calibration will also be carefully corrected.

tor, serve the best. Then mistakes, waste, and substitution in the issuing of materials will be much less prevalent. Unusual care is necessary here to keep the supply shelves and bins tidy and all supplies clean and accessible.

An inventory is usually made once a year. If this is made in the spring, when plans are being projected for the next year's work, the needs then indicated, combined with the items on the "want list" that has been kept throughout the year, will give the information required in making out the annual requisitions.

CARE AND DISTRIBUTION OF TOOLS IN THE SCHOOL PRINTSHOP

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Elizabeth, New Jersey

The efficient training of students in the school printshop is so dependent upon the manner in which the equipment is arranged that a brief consideration of arrangement and routine is first required.

Type cases must be so located that ready access may be had by the students without interfering with others. For this reason the practice of stationing a student directly in front of a tier of cases containing a series of type is not conducive to good discipline or efficient work, because it will be necessary for him to step aside every time another stu-

dent needs anything that may be contained in this particular case.

It is, therefore, recommended that the working bank be placed on the side opposite to the stack of cases. Every case should be labeled with the name, size, and printed specimen of its contents. Labels for cases of special sorts, such as fractions, signs, etc., should show clearly what is to be found therein. All display type should be arranged in series, and the series distributed throughout the room to the best advantage.

A general indexing scheme, or directory, is indispensable in the school printshop. Long and varied experience has convinced many instructors of printing that assigning a letter of the alphabet to each cabinet, and a number to each case therein, forms the best general plan.

A directory is compiled alphabetically as to the names of type faces and in the order of their size, printed as a broadside or listed on a chart and placed in a conspicuous part in the room. Sometimes a specimen book showing the cabinet letter, case number, style and size of type, and the different kinds of rule faces to be found in the shop, is given to each student. The student then has an opportunity to study at his leisure the difference in the formation of the letters in the different styles of type faces. Before setting any job, the student indicates the style and size of type which is required that he intends to use on his layout. This is submitted to his instructor for approval before he starts the job. In the same way, when type is ready for distribution, a proof is pulled, upon which the student indicates the size, style of type, etc., before he starts to distribute.

At the beginning of the term the instructor can make his own task lighter, and at the same time eliminate misunderstandings and confusion on the part of the students, if he assigns to each one a regular working place and a complete outfit consisting of stick, galley, and line gauge. For example, John Smith is given No. 1 as his number. He uses and is responsible for a case of body type which is labeled No. 1; he works on cabinet or type stand A and is responsible for its condition; he uses stick and line gauge No. 1 and it is his duty to see that they are placed on hook No. 1 at the end of every class period; his job must be tied up properly and placed on galley No. 1 which is stored in slide No. 1 of the galley cabinet for which he is responsible. When it is necessary to have more than one boy to use the same number case at different times of the day, it is surprising how quickly the others will note and report a badly mixed case due to a previous occupant; provided, of course, that each student using the case is held strictly responsible. This responsibility easily becomes a habit. When two or more boys have case No. 1 during the day,

each boy should have a separate galley on which to store his job.

In the elementary or junior-high-school printshop a single case of 10-point Roman should be used to the limit of its possibilities before other sizes and faces are introduced. This gives the student an insight into what can be accomplished with a limited assortment of types, and teaches him the importance of clean distribution and conservation of material. He also becomes well accustomed to the lay of the case and the relative thickness of the characters.

The cabinet which contains the ornaments, initials, borders, halftones, electrotypes, and zinc etchings, should also have each case numbered. A book should be kept on file containing proofs of all these materials so that the student or teacher can get them quickly, and after use return them to the proper case and compartment in the cabinet.

In the stockroom the compartments for card-board, book paper, writings, bonds, and ledgers should also be lettered. As soon as each different kind is checked up with the invoice and entered on a stock sheet designed for this purpose, it is placed in its proper compartment. When any particular kind or quality of paper is taken from the stockroom to be used on a job, it is entered on the stock sheet. The stock sheets assist in keeping a perpetual inventory of all stock purchased. The amount on hand can be easily determined and at the same time it facilitates matters in ordering stock.

An inventory of equipment such as type, machines, tools, should be taken by the instructor on the first day that he enters upon his duties as a teacher of printing or when a change of positions is made. Frequently when a teacher leaves, such an inventory is made out and given to the supervisor who has charge of printing instruction. In case a new printshop is installed, it is an easy matter to start a record from the invoices which are checked against the equipment received. As new tools, type, etc., are added, this information can be entered in the book. Any equipment discarded or sold can be recorded in the same manner. The kind, number, and condition of all equipment can be easily ascertained at any time during the school year.

When the teacher of printing meets his classes at the beginning of the school year, he should impress upon his students that doing good work is only half of being a good printer, taking care of machinery, tools, and type is the other half.

Unless the composing stick is nickel plated, it will rust from the moisture of the hand, so it is necessary for the student to clean his stick at frequent intervals. This is done with a piece of very fine sandpaper or emery cloth. After rust has been

removed, a little oil, rubbed on with an oily rag, is helpful in keeping it from rusting. A stick that is stored away during the vacation period should be well oiled and then wrapped in oiled paper or an oily rag.

If type cases are kept in open stands or racks it will be necessary to blow out the accumulation of dust in the boxes. This operation should be done once or twice during the year.

Pressed steel galleys are apt to rust, unless occasionally rubbed with oil or vaseline.

The care of leads, slugs, and rules is of importance. Students, when distributing type, are likely to form the habit of piling leads and slugs on the imposing stone or type cabinet, where under accumulating weight they are hopelessly bent. The boys should place leads, slugs, and rules on edge in separate galleys. These may then be sorted according to size and then placed in their proper places. Dirty brass rules may be cleaned by soaking them in weak lye water after which the rules are rinsed and cleaned with a rag.

The student who operates the press should clean and oil the bed of the press each morning to prevent accumulation of dust and dirt, which will affect the impression. He will see that every bright surface on his press, paper cutter, or stitching machine is kept polished, and that all tools and materials are kept in their proper places.

The instructor should assign a reliable student to dress the belts of the printing presses with a few drops of castor oil twice a week. Before the summer vacation, remove the belts from all machines.

If the press is run by individual motor, oil the motor once a week, and see that the commutator and brushes are clean, and that the points of contact on the rheostat are clean and bright. Should these points become burnt, rub them bright again with a piece of fine sandpaper.

In conclusion, system is as necessary in the school shop as in the commercial shop. It increases the interest on the part of the students because they are working in an orderly atmosphere and prepares them for entry into the trade.



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UNIVERSITY OF CALIFORNIA, Berkeley *

Director Division of Vocational Education—Edwin A. Lee

Supervisor of Classes for Training Trade and Industrial Teachers at Berkeley—Benjamin E. Mallory

UNIVERSITY OF CALIFORNIA, Los Angeles *

(Southern Branch)

Director Division of Vocational Education—Edwin A. Lee

Assistant Director and Supervisor of Classes for Training Trade and Industrial Teachers at Los Angeles—Benjamin W. Johnson

Assistant Professor of Chemical Arts and Director of Shops at Los Angeles—H. W. Mansfield

STATE TEACHERS AND JUNIOR COLLEGE, Chico *

Director Industrial Education—David F. Jackey

Auto Mechanics—Gail E. Moore

Drafting—David F. Jackey

Electricity—Russell B. Kidder

Farm Mechanics—Lloyd B. Landis

Forge—Lloyd B. Landis

General Shop—Lloyd B. Landis

Machine—Lloyd B. Landis

Sheet Metal—Lloyd B. Landis

Woodworking—Russell B. Kidder

Patternmaking—Russell B. Kidder

FRESNO STATE TEACHERS COLLEGE, Fresno *

Director Industrial Education—Lynn E. Stockwell

Assistant Professors—Perry F. Brown

W. B. Givens

H. Wheaton

Instructors—Harry E. Suiter

Henry C. Wienke

SAN DIEGO STATE TEACHERS COLLEGE, San Diego

Director Industrial Education—C. R. Scudder
Drafting—C. R. Scudder
Woodworking—C. R. Scudder

STATE TEACHERS COLLEGE, San Jose *

Director Industrial Education—H. A. Sotzin
Head of Department—B. W. Spaulding
Supervisor Cadet Teachers—A. B. Nichols
Auto Mechanics—G. H. Spearman
Architectural Drawing—B. W. Spaulding
Mechanical Drawing—H. A. Sotzin
Electricity—Judson Aspinwall
Forging and Welding—Judson Aspinwall
Farm Mechanics—Judson Aspinwall
Machine Shop—G. H. Spearman
Printing—B. W. Spaulding
Woodworking—Judson Aspinwall
Cabinetmaking—B. W. Spaulding
Carpentry—B. W. Spaulding

STATE TEACHERS COLLEGE, Santa Barbara *

Director Industrial Education—E. E. Ericson
Auto Mechanics—Wm. L. Rust
Drafting—Schurer O. Werner
Electricity—Wm. Peters
Forge—D. W. Bennett
Machine—Wm. L. Rust
Printing—D. Howard Schauer
Sheet Metal—Fred L. Griffin
Woodworking—Fred L. Griffin
Carpentry—Schurer O. Werner

COLORADO**STATE AGRICULTURAL COLLEGE, Fort Collins ***

Director Industrial Education—L. D. Crain
Associate Professors—J. H. Scofield
J. Pinsky
Geo. F. Henry
Assistant Professors—R. A. Bradley
H. H. Kob

STATE TEACHERS COLLEGE, Greeley *

Head of Industrial Education Department—Samuel M. Hadden
Assistants in Industrial Education—Kenneth F. Perry
Burl Adams

Drafting—Samuel M. Hadden
Printing—Ralph T. Bishop
Woodworking—Charles M. Foulk
Cabinetmaking—Charles M. Foulk
Carpentry—Charles M. Foulk
WESTERN STATE COLLEGE OF COLORADO, Gunnison *
Director Industrial Education—Albert M. Capron
Drafting—Albert M. Capron
Woodworking—Albert M. Capron
Cabinetmaking—Albert M. Capron
Carpentry—Albert M. Capron

DELAWARE**UNIVERSITY OF DELAWARE, Newark**

Director of Shop Practice—John L. Coyle
Drafting—Professor L. Blumberg, Head
Electricity—George A. Koerber

FLORIDA**UNIVERSITY OF FLORIDA, Gainesville**

Director Industrial Education—Albert J. Strong
Drafting—Albert J. Strong
Edgar S. Walker
W. K. Long
Forge—John H. Herder
Foundry—John H. Herder
Machine—Albert J. Strong
Woodworking—Silas K. Eshleman
Patternmaking—Albert J. Strong

FLORIDA AGRICULTURAL AND MECHANICAL COLLEGE (for Negroes), Tallahassee *

Director Industrial Education—Dean Lanier
Auto Mechanics—W. T. Reed
Drafting—James Taylor
Electricity—Samuel Thorpe
Printing—W. H. Stickney
Professor Hollins
Woodworking—P. F. Holmes, Jr.
Cabinetmaking—P. F. Holmes, Jr.
Carpentry—P. F. Holmes, Jr.

GEORGIA**STATE COLLEGE OF AGRICULTURE, Athens**

Director Industrial Education—Professor S. P. Lyle
Auto Mechanics—Professor C. F. Gorman
Drafting—Professor C. F. Gorman
Professor S. P. Lyle
Forge—Professor C. F. Gorman
Machine—Professor C. F. Gorman
Woodworking—Professor W. N. Danner, Jr.
Cabinetmaking—Professor C. F. Gorman
Carpentry—Professor Wm. N. Danner, Jr.

GEORGIA SCHOOL OF TECHNOLOGY, Atlanta *

Head of Industrial Education Department—Thomas H. Quigley
Professor of Manual Training—R. G. Sawyer
Associate Supt. of Shops—Allando A. Case
Forge Shop—H. A. Thompson

Head of Machine Design Department—Clarence E. Coolidge
Head of Architectural Department—Harold Bush-Brown
Head of Electrical Department—T. W. Fitzgerald
Foundry—William Van Houten
Wood Shop—John H. Henika
H. H. Norman

IDAHO**STATE NORMAL SCHOOL, Albion ***

Director Industrial Education—Paul E. Booker

LEWISTON STATE NORMAL SCHOOL, Lewiston *

Head of Industrial Arts Department—L. H. Thornburg

ILLINOIS**SOUTHERN ILLINOIS STATE NORMAL UNIVERSITY, Carbondale ***

Director Industrial Education—Louis C. Peterson
Industrial Methods—Louis C. Peterson
Drafting—Louis C. Peterson
Machine—Louis C. Peterson
Woodworking—Henry Schroeder
Louis C. Peterson

EASTERN ILLINOIS STATE TEACHERS COLLEGE, Charleston *

Director Industrial Education—L. F. Ashley
Auto Mechanics—W. P. Hughes
Drafting—L. F. Ashley
Electricity—L. F. Ashley
Forge—L. F. Ashley
Foundry—L. F. Ashley
Machine—L. F. Ashley
Printing—V. L. Langford
Sheet Metal—W. P. Hughes
Woodworking—V. L. Langford
W. P. Hughes

CHICAGO NORMAL COLLEGE, 6800 S. Stewart Avenue, Chicago *

Director Industrial Education—Oscar L. McMurry
Drafting—William O. Helbing
Electricity—William G. Wilson
Printing—Fred J. Thoren
Home Mechanics—William G. Wilson
Woodworking—Frank X. Henke
Cabinetmaking—Oscar L. McMurry
Carpentry—Frank X. Henke
Patternmaking—Oscar L. McMurry

LEWIS INSTITUTE, Chicago *

Director Industrial Education—Vacancy
Drafting—Wm. H. Hawley
Forge—M. C. Husted
Foundry—M. C. Husted
Machine—M. C. Husted
Sheet Metal—W. M. Dixon
Woodworking—Ian MacLeod, Leo Herdeg
Cabinetmaking—Ian MacLeod, Leo Herdeg
Carpentry—Ian MacLeod, Leo Herdeg
Patternmaking—Ian MacLeod, Leo Herdeg

UNIVERSITY OF CHICAGO, Chicago *

Director of Vocational Education—Emery T. Filbey

Theoretical Courses only

JAMES MILLIKIN UNIVERSITY, Decatur

Director Industrial Education—L. M. Cole
Auto Mechanics—Glenn Alderson
Drafting—L. M. Cole
Carl Head

Forge—L. M. Cole
Machine—Glenn Alderson
Sheet Metal—L. M. Cole
Woodwork—L. M. Cole
Cabinetmaking—L. M. Cole
Carpentry—L. M. Cole
Patternmaking—Glenn Alderson

NORTHERN ILLINOIS STATE TEACHERS COLLEGE, De Kalb *

Director Industrial Education—Milo T. Oakland
Art Metal—Paul E. Harrison
Auto Mechanics—Carl C. Cramer
Drafting—Milo T. Oakland
Household Mechanics—Carl C. Cramer
Machine—Carl C. Cramer
Printing—Milo T. Oakland
Sheet Metal—Carl C. Cramer
Woodworking—Paul E. Harrison
Cabinetmaking—Paul E. Harrison
Upholstery—Paul E. Harrison
Carpentry—Paul E. Harrison

WESTERN ILLINOIS STATE TEACHERS COLLEGE, Macomb *

Director Industrial Education—E. T. Page
Assistant in Industrial Education—Clarence Lindahl

STATE NORMAL UNIVERSITY, Normal *

Director Industrial Education—A. C. Newell
Assistants in Industrial Education—Kenyon S. Fletcher
Chester M. Hammerlund
Fred J. Knuppel

BRADLEY POLYTECHNIC INSTITUTE, Peoria *

Director Industrial Education—Albert F. Siepert
Assistant Professors—E. K. Frye
O. C. Trimble
Auto Mechanics—C. M. Hewitt
Asa Carter

Drafting—M. E. Wharry

E. J. Schlegel

H. L. McMath

Electricity—F. E. Dace

Forge—P. Becker

Machine—P. Becker

C. M. Hewitt

Sheet Metal—P. Becker

Woodworking—H. S. Clark

H. L. Hurff

Cabinetmaking—H. S. Clark

Carpentry—H. L. Hurff

Patternmaking—H. S. Clark

UNIVERSITY OF ILLINOIS, Urbana *

Professor Industrial Education—Arthur B. Mays

Associate Professor in charge of Woodworking Courses and Practice Teaching—Herbert H. Braucher

Assistant Professor—Arthur F. Dodge

Assistant—R. T. Gregg

Foundry—W. H. Spencer

Machine—F. H. Thomas

C. J. Starr

C. E. Derrough

Patternmaking—B. R. Hall

A. D. Wright

INDIANA**PURDUE UNIVERSITY, Lafayette ***

Director Vocational Education—George L. Roberts

Head Department of Practical Mechanics—James D. Hoffmann

Professor Vocational Education—Zora M. Smith

Associate Professors of Trades and Industries—Harvey G. McComb

Ammon Swope

Roy Dimmitt

Drafting—Justus Rising

Harold Huston Brelsford

Walter G. Eichenberger

Earl V. Farrar

Olan H. Hamilton

Roy Waynick Lindley

Roscoe L. Miller

G. H. Parker

Harry M. Wright

Forge—William F. Heidergott

Henry L. Daasch

Colett Jones

Elmer L. Pertz

Foundry—Robert E. Wendt

Russell W. Fowler

Leo D. Weast

Morton Tumey

Machine—William P. Turner

Chas. A. Haag

Paul J. Panlener

Glenn H. Parker

Anthony J. Vellingner

Woodworking—Ralph B. Trueblood, Head of Department

John J. Dietrich

Edward E. Falley

Royal B. Gregg

Thomas Rees

James L. Wunderlee

THE BALL STATE TEACHERS COLLEGE, Muncie *

Director Industrial Education—Ernest Sink

Assistant Professor—Hubert T. Wilhite

STATE NORMAL SCHOOL, Terre Haute *

Head Industrial Education Department—Merit L. Laubach

Assistant—H. A. Huntington

Drafting—Merit L. Laubach

Forge—A. H. Luehring

Foundry—A. H. Luehring

Machine—A. H. Luehring

Printing—John C. Tranbarger

Sheet Metal—Reuben Snitz

Woodworking—Reuben Snitz

Carpentry—Burton A. Knight

Patternmaking—Reuben Snitz

VALPARAISO UNIVERSITY, Valparaiso *

Director Industrial Education—F. W. Kroencke

Drafting—M. W. Uban

Electricity—Carl W. Lauritzen

Forge—M. W. Uban

Foundry—Harry V. Fuller

IOWA**IOWA STATE COLLEGE OF AGRICULTURE AND MECHANIC ARTS, Ames ***

Department of Industrial Arts Education—Adolph Shane, Prof.

Grover I. Mitchell, Asso. Prof.

Edmund G. Flynn, Asst. Prof.

Wm. L. Hunter, Asst. Prof.

Reuben Riedesel, Instr.

Department of Vocational Education—Wm. H. Lancelot, Head of Dept.

Herbert M. Hamlin, Assoc. Prof.

James A. Starrak, Assoc. Prof.

Barton Morgan, Assoc. Prof.

Herbert Swanson, Asst. Prof.

Theo. E. Sexauer, Asst. Prof.

Harold M. Byram, Instr.

Alfred H. Hausrath, Instr.

IOWA STATE TEACHERS COLLEGE, Cedar Falls *

Methods and Organization Courses—Charles H. Bailey

* Teacher Training for Industrial Arts offered in Summer Courses

Head of Manual Arts Department—Charles H. Bailey
 Drafting—Charles H. Bailey
 C. H. Brown
 H. G. Palmer
 Sheet Metal—C. H. Brown
 Woodworking—C. H. Brown
 H. G. Palmer
 Cabinetmaking—C. H. Brown
 H. G. Palmer
 Woodturning—C. H. Brown
 H. G. Palmer

WESTERN UNION COLLEGE, Le Mars
 Director Industrial Education—D. O. Kime

KANSAS

STATE TEACHERS COLLEGE, Emporia *
 Director Industrial Education—Clark L. Jackson
 Organization of Manual Arts—R. L. Schwanzle

Theory of Teaching Manual Arts—R. L. Schwanzle
 Drafting—Clark L. Jackson
 F. Currier

Electricity—F. Currier
 Forge—R. L. Schwanzle
 Machine—R. L. Schwanzle
 Printing—Everett Rich
 Sheet Metal—R. L. Schwanzle
 Woodworking—Clark L. Jackson
 Cabinetmaking—O. Duffin
 Furniture Construction—O. Duffin
 Woodfinishing—O. Duffin
 Woodturning—R. L. Schwanzle

KANSAS STATE TEACHERS COLLEGE, OF HAYS, Hays *

Director Industrial Education—Ed. Davis

KANSAS STATE AGRICULTURAL COLLEGE, Manhattan *

Professor Vocational Education—C. V. Williams

Auto Mechanics—W. H. Sanders
 Drafting—Rudolph Driftmeir
 Electricity—O. D. Hunt
 Forge—D. E. Lynch
 Foundry—Edward Grant
 Machine—F. W. Doelz
 Sheet Metal—Eugene Graham
 Woodworking—Eugene Graham
 Cabinetmaking—A. H. Loomis
 Carpentry—Eugene Graham
 Patternmaking—A. H. Loomis

McPHERSON COLLEGE, McPherson
 Director Industrial Education—George N. Boone

KANSAS STATE TEACHERS COLLEGE, Pittsburg *
 Director Industrial Education—A. H. Whitesitt

Practice Teaching—F. K. Bryan
 Auto Mechanics—H. V. Hartman
 Drawing and Design—O. A. Hankammer
 E. W. Baxter
 C. F. Kopp
 Electricity—E. W. Jones
 Metalworking—E. W. Baxter
 R. W. Erskine
 Printing—R. M. Coffelt
 F. J. Nevins
 F. R. Werst
 L. N. Carmain
 R. E. Farnsworth
 Woodworking—Charles R. Wasser
 F. H. Dickinson
 George E. Braley

KENTUCKY

WESTERN KENTUCKY STATE NORMAL SCHOOL, Bowling Green

Head Industrial Arts Department—L. T. Smith
 Assistant—C. B. Barnes
 Instructors—S. J. Meredith
 George Wells
 Ralph Whalin

KENTUCKY NORMAL AND INDUSTRIAL INSTITUTE, Frankfort *

Director Industrial Education—Ellis R. Deans

UNIVERSITY OF KENTUCKY, Lexington *

Director Industrial Education—A. N. May
 Acting State Supervisor of Trades and Industrial Education

EASTERN KENTUCKY STATE TEACHERS COLLEGE, Richmond *

Director Industrial Education—Noble G. Deniston
 Assistant Professor—Mrs. S. B. Hume

MAINE

EASTERN STATE NORMAL SCHOOL, Castine

Director Industrial Arts—Everett H. Nason

GORHAM NORMAL SCHOOL, Gorham

Director Industrial Education—George A. Brown

Assistants in Industrial Education—Lawrence N. Cilley
 Everett L. Packard
 Drafting—Lawrence N. Cilley
 Electricity—George A. Brown
 Forge—Lawrence N. Cilley

* Teacher Training for Industrial Arts offered in Summer Courses

Machine—George A. Brown
 Printing—Everett L. Packard
 Sheet Metal—Everett L. Packard
 Woodworking—George A. Brown
 Lawrence N. Cilley
 Cabinetmaking—George A. Brown
 Lawrence N. Cilley
 Carpentry—George A. Brown
 Patternmaking—George A. Brown
 Woodturning—George A. Brown

MASSACHUSETTS

STATE NORMAL SCHOOL, Fitchburg *
 Director of Practical Arts Department—William B. Anthony

Related Work—Ralph Weston
 Mechanical Drawing—C. Blair MacLean
 Metalworking—Arthur Purinton
 Printing—Frank S. Livermore
 Woodworking—Lawrence E. Landall
 Woodfinishing and Glazing—Charles E. Akeley

MICHIGAN

UNIVERSITY OF MICHIGAN, Ann Arbor *

Professor of Vocation and Guidance—George E. Myers

Associate Professors—Cleo Murtland

Thomas Diamond

Assistant Professors—E. L. Hayes

Marshall L. Byrn

WESTERN STATE TEACHERS COLLEGE, Kalamazoo *

Director Manual Arts Department—M. J. Sherwood

Auto Mechanics—Elmer C. Weaver
 Drafting—Fred S. Huff
 Electricity—Ed. Woods
 Forge—Elmer C. Weaver
 Foundry—M. J. Sherwood
 Machine Shop—Elmer C. Weaver
 Printing—Don Pullin
 Sheet Metal—Elmer C. Weaver
 Woodworking—Chas. S. Nichols
 Elementary Woodworking—M. J. Sherwood
 Carpentry—Chas. S. Nichols
 Woodfinishing—Chas. S. Nichols

NORTHERN STATE NORMAL SCHOOL, Marquette *

Director Industrial Education—Wayne B. McClintock

Auto Mechanics—E. A. Ferns

Drafting—Wayne B. McClintock

Electricity—E. A. Ferns

Sheet Metal—E. A. Ferns

Woodworking—E. A. Ferns

CENTRAL MICHIGAN NORMAL SCHOOL, Mount Pleasant *

Director Industrial Education—O. W. Troutman

Assistant Professor—George DePuy

RICHLAND TRAINING SCHOOL OF WESTERN STATE TEACHERS COLLEGE, Richland

Director Industrial Education—R. R. Nellist

MICHIGAN STATE NORMAL COLLEGE, Ypsilanti *

Director of Manual and Industrial Education—George A. Willoughby

Associate Professors—Alice I. Bordman

Mary E. Hatton

Assistant Professor—Belle Morrison

Instructors—C. A. Wachman

W. C. Whitney

A. O. Berg

MINNESOTA

STATE TEACHERS COLLEGE, Duluth

Director Industrial Education—F. J. Kovach

Drafting—F. J. Kovach

Woodworking—F. J. Kovach

Cabinetmaking—F. J. Kovach

STATE TEACHERS COLLEGE, Mankato

Director Industrial Education—Maurice J. Nelson

Drafting—Maurice J. Nelson

Printing—Maurice J. Nelson

Sheet Metal—Maurice J. Nelson

Woodworking—Maurice J. Nelson

Cabinetmaking—Maurice J. Nelson

Upholstering—Maurice J. Nelson

Carpentry—Maurice J. Nelson

Patternmaking—Maurice J. Nelson

UNIVERSITY OF MINNESOTA, Minneapolis *

Major Adviser: Dr. Homer J. Smith, Associate Professor

Assistant—Dr. Charles A. Prosser, Prof.

Instructors—M. Reed Bass

Ralph T. Craig

Richard A. McGee

Thomas V. Cunningham

STATE TEACHERS COLLEGE, Moorhead

Director Industrial Education—Henry B. Weltzin

STATE TEACHERS COLLEGE, St. Cloud *

Director Industrial Education—Leonard A. Williams

Assistant Directors—John Weismann

Miss Pauline Penning

STATE TEACHERS COLLEGE, Winona *

Director Industrial Education—John H. Sandt

Associate in Industrial Education—Roland M. Torgerson

Auto Mechanics—Roland M. Torgerson
 Drafting—John H. Sandt
 Electricity—Roland M. Torgerson
 Forge—Roland M. Torgerson
 Foundry—Roland M. Torgerson
 Machine—Roland M. Torgerson
 Printing—John H. Sandt
 Sheet Metal—Roland M. Torgerson
 Woodworking—John H. Sandt
 Cabinetmaking—John H. Sandt
 Patternmaking—Roland M. Torgerson

MISSISSIPPI

ALCORN AGRICULTURAL AND MECHANICAL COLLEGE, Alcorn *

Director Industrial Education—Professor P. S. Bowles

Auto Mechanics—J. C. Ussery

Forge—J. C. Ussery

Machine—J. C. Ussery

Woodworking—L. L. Roman

Cabinetmaking—L. L. Roman

Carpentry—E. R. Correll

STATE TEACHERS COLLEGE, Hattiesburg

Director Industrial Education—Charles E. Thomas

Drafting—Charles E. Thomas

Woodworking—Charles E. Thomas

Cabinetmaking—Charles E. Thomas

MISSOURI

SOUTHEAST MISSOURI STATE TEACHERS COLLEGE, Cape Girardeau *

Director Industrial Education—Orville A. Tearney

Director Elementary Industrial Education—Helen Bedford

Drafting—Orville A. Tearney

Woodworking—Orville A. Tearney

Carpentry—Charles Lamb

UNIVERSITY OF MISSOURI, Columbia *

Director Industrial Education—Professor R. W. Selvidge

Assistant Director—Ernest C. Phillips

Associates—H. H. Coxen

Walter H. Miller

A. T. Raymond

NORTHEAST MISSOURI STATE TEACHERS COLLEGE, Kirksville *

Director Industrial Education—Ben W. Leib

Associates—Alfred Hutchinson

Albert Lampson

NORTHWESTERN MISSOURI STATE TEACHERS COLLEGE, Maryville *

Director Industrial Education—U. G. Whiffen

Drafting—U. G. Whiffen

Sheet Metal—U. G. Whiffen

Woodworking—U. G. Whiffen

Cabinetmaking—U. G. Whiffen

CENTRAL MISSOURI STATE TEACHERS COLLEGE, Warrenburg *

Director Industrial Education—Noel B. Grinstead

Drafting—Noel B. Grinstead

Woodworking—Noel B. Grinstead

R. E. Smith (Summer Quarter)

Carpentry—Charles Reichle, Jr.

MONTANA

STATE NORMAL COLLEGE, Dillon *

Director Industrial Education—O. Kay Moe

NEBRASKA

NEBRASKA STATE TEACHERS COLLEGE, Kearney *

Director Industrial Education—Verne C. Fryklund, Prof.

Problems in Teaching Technique

Trade Analysis

Drafting—Walter Klehm

General Metal—Walter Klehm

Woodworking—Otto C. Olsen

Cabinetmaking—Otto C. Olsen

NEBRASKA WESLEYAN UNIVERSITY, Lincoln *

Director Industrial Education—Robert A. Hardin

Teacher Training—Robert A. Hardin

Auto Mechanics—J. C. Jensen

Drafting—Robert A. Hardin

Electricity—J. C. Jensen

Woodworking—Robert A. Hardin

Cabinetmaking—Robert A. Hardin

Carpentry—Robert A. Hardin

Patternmaking—Robert A. Hardin

UNIVERSITY OF NEBRASKA, Lincoln *

Director Vocational Education—H. E. Bradford

STATE NORMAL SCHOOL AND TEACHERS COLLEGE, Peru *

Director Industrial Education—A. V. Larson

Supervisor Industrial Education—J. R. Van Dyke

Auto Mechanics—J. R. Van Dyke

Drafting—A. V. Larson

Sheet Metal—J. R. Van Dyke

Woodworking—A. V. Larson

SANTEE NORMAL TRAINING SCHOOL, Santee

Director Industrial Education—F. B. Riggs

Drafting—F. B. Riggs

Electricity—F. B. Riggs

Forge—Robert Brown

Printing—C. R. Lawson

Carpentry—F. B. Riggs

STATE NORMAL SCHOOL AND TEACHERS COLLEGE, Wayne*

Director Industrial Education—E. J. Hunter
 Assistant in Industrial Education—Ray Hickman
 Drafting—E. J. Hunter
 Woodworking—E. J. Hunter
 Cabinetmaking—E. J. Hunter
 Carpentry—E. J. Hunter

NEW HAMPSHIRE UNIVERSITY OF NEW HAMPSHIRE, Durham*

Director Industrial Education—Justin O. Wellman
 Auto Mechanics—E. T. Donovan
 Drafting—Thomas J. Laton
 Electricity—Frederick D. Jackson
 Forge—Elias O'Connell
 Foundry—Edward L. Getchell
 Machine—John Tomkin
 Woodworking—Lyman J. Batchelder
 Cabinetmaking—Lyman J. Batchelder
 Carpentry—Lyman J. Batchelder
 Patternmaking—Lyman J. Batchelder

STATE NORMAL SCHOOL, Keene*

Director Industrial Education—Conrad A. Adams
 Auto Mechanics—Conrad A. Adams
 Drafting—Walter A. Pierce
 Electricity—Conrad A. Adams
 Foundry—Conrad A. Adams
 Machine—Conrad A. Adams
 Printing—Clarence H. DeMar
 Woodworking—Roy L. Terrill
 Cabinetmaking—Spencer E. Eaton
 Carpentry—Spencer E. Eaton
 Patternmaking—Spencer E. Eaton

NEW JERSEY STATE NORMAL SCHOOL, Newark

Director Industrial Education—John J. Hatch
 Associates—Fred M. Richmond
 G. M. Engels
 M. Judd Wilson
 J. A. D'Angola
 Lillian Kreiner

STATE TEACHERS COLLEGE, Trenton

Director Industrial Education—C. A. Burt
 Assistants in Industrial Education—M. Gaston
 E. W. Crowell
 V. Crowell
 Drafting—C. A. Burt
 Electricity—Dr. W. L. Eikenberry
 Sheet Metal—C. A. Burt
 Woodworking—C. A. Burt
 Cabinetmaking—C. A. Burt
 Carpentry—C. A. Burt
 Patternmaking—C. A. Burt

NEW MEXICO STATE NORMAL UNIVERSITY, East Las Vegas*

Director Industrial Education—E. J. Mayer
NEW MEXICO STATE COLLEGE OF AGRICULTURE AND MECHANICAL ARTS, State College
 Director Industrial Education—M. T. Lewellen
 Forge—M. T. Lewellen
 Woodworking—M. T. Lewellen
 Carpentry—M. T. Lewellen
 Patternmaking—M. T. Lewellen

NEW YORK ALFRED UNIVERSITY, Alfred*

Director Industrial Education—Prof. E. Fritjof Hildebrand
 Auto Mechanics—Prof. E. Fritjof Hildebrand
 Prof. Clifford M. Potter
 Drafting—Prof. Clifford M. Potter
 Leland Williams
 Machine—Prof. E. Fritjof Hildebrand
 Leland Williams
 Woodworking—Prof. E. Fritjof Hildebrand
 Cabinetmaking—Prof. E. Fritjof Hildebrand

STATE NORMAL SCHOOL, Brockport

Director Industrial Education—Edwin E. Nihiser

STATE TEACHERS COLLEGE, 14th and Jersey Sts., Buffalo

Director Industrial Education—Irving C. Perkins
 Assistants—Andrew W. Grabau
 Edward L. Morrice
 Drafting—George M. Quackenbush
 Electricity—Walter B. Weber
 Forge—John Fontana
 Machine—John Fontana
 Printing—George E. Huckins
 Sheet Metal—John Fontana
 Woodworking—Clinton B. Burke
 Cabinetmaking—Clinton B. Burke
 Carpentry—Clinton B. Burke
 Patternmaking—Clinton B. Burke

STATE NORMAL SCHOOL, Fredonia*

Director Industrial Education—Frederick W. Landers

CORNELL UNIVERSITY, Ithaca*

Director Vocational Education—L. M. Roehl
 Auto Mechanics—F. B. Wright
 Electricity—F. B. Wright

* Teacher Training for Industrial Arts offered in Summer Courses

General Shop—L. M. Roehl
 F. B. Wright
 Metalworking—L. M. Roehl
 Woodworking—L. M. Roehl
 Carpentry—L. M. Roehl

THE COLLEGE OF THE CITY OF NEW YORK, New York

Head Dept. of Education—Paul Klapper
 Department of Vocational Education—I. David Cohen

NEW YORK UNIVERSITY, Washington Square, East, New York*

Director Industrial Arts Education and Vocational Education—Ralph E. Pickett
 Assistants—Andrew D. Althouse
 Frank M. Granger
 Layton S. Hawkins
 Louis Heller
 Harry S. Hoag
 Daniel Joseph
 Franklin J. Keller
 Ronald W. Kent
 Edward D. Griswold
 J. Ritchie Stevenson
 Roland H. Spaulding
 John H. Shaver
 Garton K. Wagar

TEACHERS COLLEGE, COLUMBIA UNIVERSITY, New York City*

Director Industrial Arts—Frederick G. Bonser
 Director Vocational Education—D. S. Snedden
 Assistant in Industrial Education—Dr. Fred Strickler

STATE NORMAL SCHOOL, Oswego*

Director Industrial Education—Joseph C. Park
 Supervisor—Arthur Hauler
 Associate—Leo T. Cribben
 Drafting—Wadsworth M. Scoville
 Electricity—Harry M. Karcher
 General Shop—Gene Essex
 Machine—Ransom I. Libby
 Printing—Jay D. Rudolph
 Woodworking—Frank E. Schneider

NORTH CAROLINA ASHEVILLE NORMAL SCHOOL, Asheville*

Director Industrial Education—Delfido Cordova

NEGRO AGRICULTURAL AND TECHNICAL COLLEGE, Greensboro*

Teacher Training Supervisor Industrial Education—E. R. Garrett
 Auto Mechanics—G. B. Love
 Drafting—A. W. Ferguson
 H. C. Taylor
 Electricity—F. A. Gregory
 Forge—M. F. Holt
 Machine—R. L. Campbell
 Woodworking—A. D. Lomax
 Cabinetmaking—A. D. Lomax
 Carpentry—A. D. Lomax
 Patternmaking—A. D. Lomax

INDIAN NORMAL SCHOOL, Pembroke*

Director Industrial Education—Professor R. B. Harper
 Auto Mechanics—Professor R. B. Harper
 Drafting—Professor R. B. Harper
 Carpentry—Professor R. B. Harper

NORTH CAROLINA STATE COLLEGE OF AGRICULTURE AND ENGINEERING, Raleigh*

Director of Teacher Training in Trades and Industries—Edward W. Boshart
 Assistant Professor Vocational Education—L. O. Armstrong
 Superintendent of Shops—C. B. Park
 Drafting—John M. Foster
 Thomas J. Martin
 Everett H. Shands
 Forge—Walter B. Voll
 Woodworking—Fred B. Wheeler

NORTH DAKOTA STATE NORMAL SCHOOL, Dickinson*

Director Industrial Education—Roy L. Co-ville

STATE NORMAL AND INDUSTRIAL SCHOOL, Ellendale*

Director Industrial Education—M. W. Heckmann

Auto Mechanics—L. R. Lynde
 Drafting—M. W. Heckmann
 Forge—L. R. Lynde
 Machine—M. W. Heckmann
 Sheet Metal—Clyde Workman
 Woodworking—Clyde Workman
 Cabinetmaking—Clyde Workman
 Carpentry—G. Driefke

NORTH DAKOTA AGRICULTURAL COLLEGE, Fargo

Director Industrial Education—R. M. Dolve
 Auto Mechanics—M. B. Erickson
 Drafting—M. B. Erickson
 Electricity—H. S. Rush
 Forge—H. Chisholm
 Foundry—H. Chisholm
 Machine—M. B. Erickson
 Woodworking—G. A. Anderson
 Cabinetmaking—G. A. Anderson
 Carpentry—G. A. Anderson
 Patternmaking—G. A. Anderson

UNIVERSITY OF NORTH DAKOTA, Grand Forks*

Director Industrial Education—E. W. Bollinger, Asst. Prof.
 Drafting—R. R. Harding
 Electricity—E. W. Bollinger
 Forge—A. W. Preston
 Foundry—A. W. Preston
 Machine—A. W. Preston
 Printing—E. W. Bollinger
 Sheet Metal—E. W. Bollinger
 Woodworking—R. R. Harding
 Cabinetmaking—R. R. Harding
 Carpentry—R. R. Harding
 Patternmaking—A. W. Preston
STATE TEACHERS COLLEGE, Minot*
 Director Industrial Education—D. C. Blide
STATE TEACHERS COLLEGE, Valley City*
 Director Industrial Education—Stanley My-thaler

OHIO STATE TEACHERS COLLEGE AND MUNICIPAL UNIVERSITY OF AKRON, Akron*

Director Industrial Education—R. H. Waterhouse

Associates—Russell J. Greenly
 Horace M. Jellison

Drafting—R. J. Dushinake

OHIO UNIVERSITY, Athens*

Director Industrial Education—Geo. E. McLaughlin
 Foundry—Geo. E. McLaughlin
 Home Mechanics—C. R. Kinison
 Machine—Geo. E. McLaughlin
 Printing—C. R. Kinison
 Sheet Metal—Geo. E. McLaughlin
 Woodworking—D. S. Grones
 Cabinetmaking—D. S. Grones
 Patternmaking—C. R. Kinison

STATE NORMAL SCHOOL, Bowling Green*

Director Industrial Education—D. J. Crowley
 Assistant in Industrial Education—E. C. Powell

Drafting—E. C. Powell
 Electricity—D. J. Crowley

Forge—E. C. Powell
 Printing—D. J. Crowley

Sheet Metal—E. C. Powell
 Woodworking—E. C. Powell

Cabinetmaking—E. C. Powell
 Patternmaking—E. C. Powell

CLEVELAND SCHOOL OF EDUCATION, Cleveland*

Head of Department of Vocational Education—Howard Briggs

THE OHIO STATE UNIVERSITY, Columbus*

Chairman Industrial and Vocational Education Department—Wm. H. Stone
 Associate Professor—Wm. E. Warner
 Assistant Professor—Robert E. Smith
 Assistants—Charles H. Wickoff
 Herbert H. Hutchinson

KENT STATE NORMAL SCHOOL, Kent*

Head of Manual Training Department—Clinton S. Van Deusen
 Manual Training for Middle Grades—Clinton S. Van Deusen
 Drafting—Clinton S. Van Deusen
 Woodworking—Clinton S. Van Deusen
 Electricity and Sheet Metal in Summer Course only

MIAMI UNIVERSITY, Oxford*

Director Division of Special Subjects and Professor of Industrial Education—Fred C. Whitcomb

Auto Mechanics—Eugene Albaugh

Drafting—Albert A. Grinnell

Electricity—Eugene Albaugh

Forge—Eugene Albaugh

Foundry—Eugene Albaugh

Printing—Douglass W. Harris

Sheet Metal—Eugene Albaugh

Woodworking—Wm. D. Stoner

Cabinetmaking—Wm. D. Stoner

Carpentry—Wm. D. Stoner

Patternmaking—Wm. D. Stoner

WILBERFORCE UNIVERSITY, Wilberforce*

Director of Vocations—A. M. Chavous

Drafting—James A. Byrd

Forge—A. C. Ginn

Machine—James A. Byrd

Woodworking—Alonzo C. Deleo

OKLAHOMA EAST CENTRAL STATE TEACHERS COLLEGE, Ada*

Director Industrial Education—Hugh Norris

Assistant Director—Denton Floyd

Associate—M. A. Wallace

NORTHWESTERN STATE NORMAL SCHOOL, Alva*

Director Industrial Education—Stanley W. May

Assistant in Industrial Education—Ralph Andree

Drafting—Stanley W. May

Forge—Ralph Andree

Woodworking—Stanley W. May

Cabinetmaking—Stanley W. May

SOUTHEASTERN TEACHERS COLLEGE,
Durant *

Director Industrial Education—C. B. French
 Assistants in Industrial Education—W. E. Lambert
 Mrs. Hattie Rainey

CENTRAL STATE TEACHERS COLLEGE,
Edmond *

Head Department Industrial Arts—E. L. Chase
 Assistant in Industrial Arts—Graden Waters

Drafting—B. D. Gambel
 Electricity—E. L. Chase
 Forge—E. L. Chase
 Foundry—E. L. Chase
 Woodworking—E. L. Chase

PANHANDLE AGRICULTURAL AND MECHANICAL COLLEGE, Goodwell *

Director Industrial Education—Marvin L. Carter

COLORADO AGRICULTURAL AND NORMAL INSTITUTE, Langston *

Director of Trade Education—E. A. Miller
 Auto Mechanics—H. J. Hendricks
 Drafting—E. A. Miller

H. J. Hendricks
 Electricity—E. A. Miller
 Forge—J. S. Johnson
 Machine—H. J. Hendricks
 Printing—Mrs. M. Weaver
 Woodworking—Chas. King
 Cabinetmaking—Chas. King
 Carpentry—H. Jones
 Patternmaking—Chas. King

UNIVERSITY OF OKLAHOMA, Norman

Director Industrial Education—Murdo Cameron

Drafting—Frank Morris
 Forge—Murdo Cameron
 James A. Fenn
 T. K. Davis

Machine—T. K. Davis
 Cabinetmaking—Murdo Cameron
 Carpentry—Murdo Cameron
 Patternmaking—Murdo Cameron

OKLAHOMA AGRICULTURAL AND MECHANICAL COLLEGE, Stillwater *

Director Industrial Education—DeWitt T. Hunt

Associates—H. G. Thuesen
 E. D. Soderstrom
 F. R. Bradley
 A. C. Cobb
 C. W. Briles
 C. R. Wood

NORTHEASTERN STATE TEACHERS COLLEGE, Tahlequah *

Director Industrial Education—M. E. Franklin

Drafting—M. E. Franklin
 Machine—M. E. Franklin
 Printing—M. E. Franklin
 Woodworking—M. E. Franklin
 Claude Neet
 Cabinetmaking—M. E. Franklin
 Carpentry—M. E. Franklin

SOUTHWESTERN STATE TEACHERS COLLEGE, Weatherford *

Director Industrial Education—Wm. E. Phillips

Drafting—Wm. E. Phillips
 Woodworking—Ervin E. Kaiser
 Cabinetmaking—Ervin E. Kaiser
 Carpentry—Ervin E. Kaiser

OREGON**OREGON AGRICULTURAL COLLEGE,** Corvallis *

Dean, School of Vocational Education—J. R. Jewell
 Director of Industrial Education—Geo. B. Cox

Auto Mechanics—M. L. Granning
 Clyde Walder
 Drafting—E. C. Willey
 R. F. Newton
 W. H. Paul
 F. W. Ervast
 Electricity—D. B. Stuart
 Forge—W. H. Horning
 Foundry—A. E. Ridenour
 Home Mechanics—F. L. France
 Machine Shop—M. L. Granning
 A. C. Harwood
 Patternmaking—E. D. Meyer
 Sheet Metal—E. D. Meyer
 Woodworking—F. L. France
 Cabinetmaking—Geo. B. Cox
 E. D. Meyer
 Carpentry—E. D. Meyer

PENNSYLVANIA**MILLERSVILLE STATE NORMAL SCHOOL,** Millersville *

Director Industrial Education—Lester R. Uhrich

Woodworking—Lester R. Uhrich
 Carpentry—Lester R. Uhrich

UNIVERSITY OF PENNSYLVANIA, Philadelphia

Director Vocational Teacher Training—William C. Ash
 Assistant Director—W. H. Magill

* Teacher Training for Industrial Arts offered in Summer Courses

Professor of Shop Work—L. N. Gulick
 Drafting—H. R. Fry
 Forge—G. Bloemker
 Foundry—G. Bloemker
 Machine—G. Bloemker
 Woodworking—G. Fawkes

CARNegie INSTITUTE OF TECHNOLOGY, College of Industries, Pittsburgh *

Head, Department of Industrial Education—Glen U. Cleeton

Professional Courses—Glen U. Cleeton

Edwin H. Smith
 Auto Mechanics—James W. Trimmer

A. R. Platt
 J. W. Hobe
 Drafting—Harry M. McCully

Ernest B. Nettleton
 Valentine F. Smith

William G. Sullivan
 Michael S. Schonvizer

Vincent P. Sollom
 Walter H. Stulen

Electricity—Frank C. Ashe
 Wilbur R. Yarlett

Forge—John Blackhall
 William Aiton

Foundry—William H. Dosey
 Jacob D. Utech

Machine—Howard G. Potter
 William B. Hartman

Printing—David B. Gustafson
 Meiric K. Dutton

Porter Garnett
 Walter B. Gress

John C. Martin
 George F. Thomas

Reese C. David
 A. Warren Lunt

Sheet Metal—Martin Raubenstraw
 Cabinetmaking—Edwin H. Smith

Carpentry—Ralph M. Young
 Patternmaking—William Plouts

Kent Shaffer

UNIVERSITY OF PITTSBURGH, O'Hara and Thackeray Sts., Pittsburgh *

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Professor of Vocational Education—A. M. Goldberger

Assistant in Vocational Education—Ted. A. Siedle

RHODE ISLAND**RHODE ISLAND COLLEGE OF EDUCATION,** Gaspee St., Providence *

Director of Vocational Education—Charles Carroll

Theoretical Courses only.

SOUTH CAROLINA**CLEMSON AGRICULTURAL COLLEGE,** Clemson College *

Head, Division of Industrial Education—H. S. Tate

Assistants in Industrial Education—J. L. Brock

J. L. Marshall
 Auto Mechanics—L. R. Booker

Drafting—W. W. Klugh
 D. N. Harris

Electricity—W. B. Wilson
 Forge—J. M. Johnson

Foundry—J. M. Johnson
 Machine—E. J. Freeman

Sheet Metal—E. J. Freeman
 Woodworking—J. L. Marshall

Patternmaking—J. L. Marshall

STATE AGRICULTURAL AND MECHANICAL COLLEGE, Orangeburg *

Director Industrial Education—Miller F. Whitaker

Auto Mechanics—C. Raymond Clagett
 Drafting—Wm. W. Wilkins

Electricity—Phillip M. Harris
 Forge—Wm. M. Williams

Machine—Wm. W. Williams
 Sheet Metal—W. T. Calhoun

Shoemaking—Wm. C. Lewis
 Woodworking—James A. Pierce

SOUTH DAKOTA**THE NORTHERN NORMAL AND INDUSTRIAL SCHOOL,** Aberdeen *

Director Industrial Education—Henry P. Gerber

EASTERN STATE TEACHERS COLLEGE, Madison

Director Industrial Education—L. N. Pease

Drafting—L. N. Pease

R. Martin
 Electricity—L. N. Pease

Sheet Metal—L. N. Pease

R. Martin
 Woodworking—L. N. Pease

R. Martin
 Cabinetmaking—L. N. Pease

R. Martin
 Carpentry—L. N. Pease

R. Martin

STATE NORMAL SCHOOL, Spearfish *

Director Industrial Education—Melvin Haslem

Woodworking—Melvin Haslem
 Cabinetmaking—Melvin Haslem

Carpentry—Melvin Haslem

SOUTHERN STATE NORMAL SCHOOL, Springfield *

Director Industrial Education—Oran J. House

Drafting—Oran J. House

Woodworking—Oran J. House

Cabinetmaking—Oran J. House

Carpentry—Oran J. House

TENNESSEE**TENNESSEE POLYTECHNIC INSTITUTE,** Cookeville *

Director Industrial Education—Professor R. M. Smith

EAST TENNESSEE STATE TEACHERS COLLEGE, Johnson City

Director Industrial Education—Walter C. Wilson

Methods of the Industrial Arts—Walter C. Wilson

Architectural Design—Walter C. Wilson

Drafting—L. D. Wallis

Metal Work—Walter C. Wilson

UNIVERSITY OF TENNESSEE, Knoxville *

Director Industrial Education—Clyde H. Wilson

Auto Mechanics—Harold A. Arnold

Drafting—R. C. Matthews

Andy T. Hendrix
 Electricity—Arthur B. Wood

Foundry—Leo Holdredge

Machine—Duncan A. White

Carpentry—Harold A. Arnold

Patternmaking—Wm. I. Denton

WEST TENNESSEE STATE TEACHERS COLLEGE, Memphis *

Director Industrial Education—Wm. H. Pleasants

Assistant—Joe Austin

GEORGE PEABODY COLLEGE FOR TEACHERS, Nashville *

Director of Industrial Education—T. T. Lindsey

Associates: Lawton L. Gore

Clarence H. Lander

L. W. Jones

Ben W. Young

TENNESSEE AGRICULTURAL AND INDUSTRIAL STATE COLLEGE, Nashville *

Director Industrial Education—W. H. Mott

Assistant—Frances E. Thompson

Drafting—C. W. McCray

Woodworking—C. W. McCray

TEXAS**SUL ROSS STATE TEACHERS COLLEGE,** Alpine *

Professor of Industrial Education—V. J. Smith

Theory and Practice Teaching

NORTH TEXAS AGRICULTURAL COLLEGE, Arlington

Director Industrial Education—Miss Laura Murray, Chief Director of Teacher Training—University of Texas

WEST TEXAS STATE TEACHERS COLLEGE, Canyon *

Director Industrial Education—R. A. Terrill

Associate Professor—J. A. Gillis

AGRICULTURAL AND MECHANICAL COLLEGE OF TEXAS, College Station *

Head of Department of Industrial Education—Edward L. Williams

Dean of School of Vocational Teaching—Dr. C. H. Winkler

Associate Professor Industrial Education—G. H. Fern

Auto Mechanics—F. R. Jones

Drafting—A. Mitchell

Ernest Langford

Electricity—A. H. Kerns

Foundry—W. W. McCarter

Machine—Walter Downard

Sheet Metal—M. F. Thurmond

Cabinetmaking—D. W. Flemming

Carpentry—M. F. Thurmond

Patternmaking—D. W. Flemming

EAST TEXAS STATE TEACHERS COLLEGE, Commerce *

Director Industrial Education—Joseph G. Grove

Assistants—L. D. Keaton

G. W. Kibler

Sam Ford

NORTH TEXAS STATE TEACHERS COLLEGE, Denton *

Director Industrial Education—Hugo J. P. Vitz

Visual Aids Courses—Hugo J. P. Vitz

Methods and Personality—Hugo J. P. Vitz

Auto Mechanics—

Drafting—H. H. London

Hugo J. P. Vitz

Printing—J. D. Hall

Woodworking—H. H. London

Cabinetmaking—H. H. London

Carpentry—H. H. London

Patternmaking—H. H. London

SAM HOUSTON STATE TEACHERS COLLEGE, Huntsville *

Director Industrial Education—Victor Randal

Assistant—Ben W. Young

STATE NORMAL AND INDUSTRIAL

COLLEGE, Prairie View*
 Teacher Training—G. O. Sanders
 Director Industrial Education—J. J. Abernethy
 Associate—L. E. Fry
 Auto Mechanics—N. A. Jones
 Drafting—Claude L. Wilson
 Electricity—D. W. Martin
 Forge—D. F. Daily
 Machine—N. A. Jones
 Printing—William Cook
 Sadie A. Johnson
 Chas. G. Oler
 Sheet Metal—Wm. L. Muckelroy
 Woodworking—Chas. E. Johnson
 A. J. Wallace
 Carpentry—L. J. Collier
 R. Adams

SOUTHWEST TEXAS STATE TEACHERS

COLLEGE, San Marcos*
 Director Industrial Arts—W. R. Boucher
 Auto Mechanics—J. A. Clayton
 Drafting—W. R. Boucher
 Woodworking—W. R. Boucher
 Carpentry—W. R. Boucher

JOHN TARLETON AGRICULTURAL

COLLEGE, Stephenville*
 Director Industrial Education—Professor Oscar Frazier

UTAH**AGRICULTURAL COLLEGE OF UTAH,**

Logan*
 Dean of Industrial Education Department—R. B. West
 Auto Mechanics—A. H. Powell
 Drafting—V. C. Tingey
 Electricity—Sidney Stock
 Forge—Roy Egbert
 Foundry—A. H. Powell
 Machine—Aron Newey
 Sheet Metal—Roy Egbert
 Cabinetmaking—Daniel C. Swenson
 Carpentry—August J. Hanson

BRIGHAM YOUNG UNIVERSITY, Provo*

Director Industrial Education—William H. Snell
 Auto Mechanics—Percival P. Bigelow
 Drafting—W. H. Snell
 Woodworking—W. H. Snell
UNIVERSITY OF UTAH, Salt Lake City
 Director Industrial Education—Professor E. H. Beckstrand
 Drafting—Assistant Professor A. Harold Blake
 Electricity—Professor A. L. Taylor
 Forge—Assistant Professor A. Harold Blake
 Foundry—Assistant Professor A. Harold Blake
 Cabinetmaking—Harvey E. Gardner
 Patternmaking—Assistant Professor A. Harold Blake

VIRGINIA**VIRGINIA NORMAL AND INDUSTRIAL**

INSTITUTE, Ettricks*
 Director Industrial Education—H. E. Fauntleroy
 Assistant in Industrial Education—F. T. Greene
 Auto Mechanics—H. D. Harris
 Drafting—H. E. Fauntleroy
 Electricity—F. R. Wood
 Machine—H. D. Harris
 Cabinetmaking—P. M. Vaughan
 Carpentry—L. T. Pinn

HAMPTON NORMAL AND AGRICULTURAL

INSTITUTE, Hampton*
 Director of Trade School—H. J. DeYarment
 Assistant—Jean Gilman
 Auto Mechanics—P. J. Vick
 Drafting—R. P. Wolf
 H. W. Myrick
 Electricity—C. S. Isham
 Forge—W. C. Douglass
 Machine—F. J. Robinson
 Alfred Vick
 Printing—Frank M. Ladd
 Sheet Metal—W. B. Baker
 Cabinetmaking—W. H. Keffie
 Carpentry—Edgar Bentzel

WASHINGTON**STATE NORMAL SCHOOL, Bellingham***

Director Industrial Education—Herbert C. Ruckmick
 Industrial Arts for Elementary Schools
 Industrial Arts for Junior High Schools
 Industrial Arts for Primary, Intermediate, and Rural Schools—J. C. Gunther
 Assistant in Industrial Education—Paul H. Rule
 Drafting—Paul H. Rule
 Electricity—Herbert C. Ruckmick
 Foundry—H. C. Ruckmick
 Printing—R. D. Wilson

* Teacher Training for Industrial Arts offered in Summer Courses

Sheet Metal—Paul H. Rule
 Woodworking—Paul H. Rule
 Cabinetmaking—Paul H. Rule
 General Shop—Herbert C. Ruckmick
STATE NORMAL SCHOOL, Cheney*
 Director Industrial Education—Edward Lamont Dales
 Assistant in Industrial Education—James S. Lane
STATE NORMAL SCHOOL, Ellensburg*
 Director Industrial Education—Glenn Hogue
STATE COLLEGE OF WASHINGTON, Pullman*
 Director Industrial Education—Hubert V. Carpenter
 Associate—Royal D. Sloan
 Auto Mechanics—G. R. Sayles
 Drafting—G. E. Thornton
 Forge—Roncisco J. Davis
 Foundry—George Lommason
 Machine—George Lommason
 Printing—Thomas J. O'Day
 Woodworking—S. C. Roberts
 Cabinetmaking—S. C. Roberts
 Carpentry—S. C. Roberts

WEST VIRGINIA**WEST VIRGINIA UNIVERSITY, Morgan-**

town*
 Director Industrial Education—Edward S. Maclin
 Superintendent of Shops—J. H. Gill
 Drafting—George W. Grow
 Bennett S. White
 Harold M. Cather
 Harold F. Kruger
 Electricity—A. A. Hall
 Foundry—Rufus West
 Wm. J. Carl
 Machine—Leslie D. Hayes
 James H. Gill
 Wm. O. Gnagey
 Sheet Metal—R. A. West
 Woodworking—Herman D. Stillman
 Cabinetmaking—R. E. Seaman

WISCONSIN**STATE TEACHERS COLLEGE, Eau**

Claire*
 Director Industrial Education—M. B. Milliren
UNIVERSITY OF WISCONSIN, Madison*
 Chairman, Dept. of Industrial Education and Applied Arts—A. H. Edgerton
 Associate Professor of Applied Arts—Wm. H. Varnum
 Assistant Professor of Industrial Education—John F. Friese
 Assistant Professor of Mechanical Practice—James M. Dorrans
 Auto Mechanics—Roy A. Hinderman
 Drafting—Herbert D. Orth, Associate Professor
 H. P. Doka
 Forge—R. N. Schumann
 C. F. Peters
 Foundry—B. B. Bridge
 G. Young
 Machine—R. R. Bell
 George Hitchcock
 Roy A. Hinderman
 T. Puddester
 Sheet Metal—Roy A. Hinderman
 Woodworking—Roy A. Hinderman
 Cabinetmaking—Roy A. Hinderman
 Carpentry—J. B. Culey
 Patternmaking—N. F. Hollander

STOUT INSTITUTE, Menomonie*

Dean of the School of Industrial Education—Clyde A. Bowman
 Auto Mechanics—H. F. Good
 Ray F. Kranzsch
 Drafting—Paul C. Nelson
 Daniel Green
 James Early
 Electricity—H. F. Good
 Ray F. Kranzsch
 Foundry—H. C. Milnes
 Home Mechanics—F. E. Tustison
 Ray F. Kranzsch
 Machine—H. C. Milnes
 Printing—C. W. Hague
 Sheet Metal—Floyd Keith
 Woodworking—Thomas W. Johnson
 Cabinetmaking—H. M. Hansen
 Furniture and Upholstery—Fred L. Curran
 Woodfinishing—Thomas W. Johnson
 Millwork—H. M. Hansen
 Patternmaking—H. C. Milnes
MILWAUKEE VOCATIONAL SCHOOL,
 Teacher Training Division, 7th and Highland Avenues
 Chief of Teacher Training Division—R. H. Rodgers
WISCONSIN STATE TEACHERS COLLEGE, Milwaukee

Director Industrial Education—Alfred S. Madsen

STATE TEACHERS COLLEGE, Oshkosh*

Supervisor and Acting Director Industrial Education—H. H. Whitney
 Auto Mechanics—N. T. Shrum
 Drafting—F. W. Walsh
 Electricity—R. T. Grant
 Forge—F. E. Just
 Foundry—R. E. Gruenhagen
 Machine—F. E. Just
 Sheet Metal—H. T. Shrum
 Woodworking—N. T. Shrum
 R. E. Gruenhagen
 Cabinetmaking—R. E. Gruenhagen
 Carpentry—H. T. Shrum
 Patternmaking—R. E. Gruenhagen

STATE TEACHERS COLLEGE, Platteville*

Director Industrial Education—V. M. Russell
 Assistants in Industrial Education—E. J. Stoneman
 G. P. Deyoe
 Auto Mechanics—V. M. Russell
 Drafting—E. J. Stoneman
 Electricity—J. W. White
 Forge—E. J. Stoneman
 Printing—V. M. Russell
 Cabinetmaking—V. M. Russell
 Carpentry—E. J. Stoneman
 Patternmaking—V. M. Russell

STATE TEACHERS COLLEGE, River

Falls*
 Director Industrial Education—R. E. Spriggs
 Assistants in Industrial Education—Wm. Segerstrom
 Fred Christensen
 Auto Mechanics—R. E. Spriggs
 Drafting—Wm. Segerstrom
 R. E. Spriggs
 Forge—R. E. Spriggs
 Wm. Segerstrom
 Machine—R. E. Spriggs
 Printing—Wm. Segerstrom
 Sheet Metal—Wm. Segerstrom
 Woodworking—Wm. Segerstrom
 Fred Christensen
 Cabinetmaking—Wm. Segerstrom
 Fred Christensen
 Carpentry—Wm. Segerstrom
 Fred Christensen

STATE NORMAL COLLEGE, Stevens

Point*
 Director Industrial Education—Victor E. Thompson

STATE TEACHERS COLLEGE, Superior

Director Industrial Education—V. E. Brauman
 Industrial Art Work for rural schools.
STATE TEACHERS COLLEGE, Whitewater*
 Director Industrial Education—C. H. Wellers

CANADA**PROVINCIAL INSTITUTE OF TECHNOLOGY AND ART, Calgary, Alberta**

Director Industrial Education—W. G. Corventes
 Assistants in Industrial Education—J. H. Ross
 James Fowler
 L. H. Bennett
 A. E. Hutton

HAMILTON TECHNICAL INSTITUTE,

Wentworth St., North, Hamilton, Ontario*

Director Industrial Education—F. P. Gavin
 Auto Mechanics—J. L. Cleland
 Drafting—E. D. W. Courtice
 Electricity—A. G. McLeish
 Machine—F. H. Kirkpatrick
 Printing—F. H. Atkinson
 Sheet Metal—W. E. Rambo
 Woodworking—F. J. Evans
 Cabinetmaking—F. J. Evans
 Carpentry—W. C. Thrasher
 Patternmaking—G. Walker

NORMAL SCHOOL, Hamilton, Ontario*

Director Manual Training—A. J. Painter

Assistant in Manual Training—J. A. Chrysler

Drafting—A. J. Painter

Woodworking—A. J. Painter

ONTARIO TRAINING SCHOOL FOR

TECHNICAL TEACHERS, Hamilton, Ontario*

Head Industrial Education Department—F. P. Gavin

Assistant—M. A. Sorsoleil

Woodworking—A. Styles

NORMAL SCHOOL, Ottawa, Ontario*

Director Industrial Education—Jas. S. Harterre

Woodworking (Elementary)

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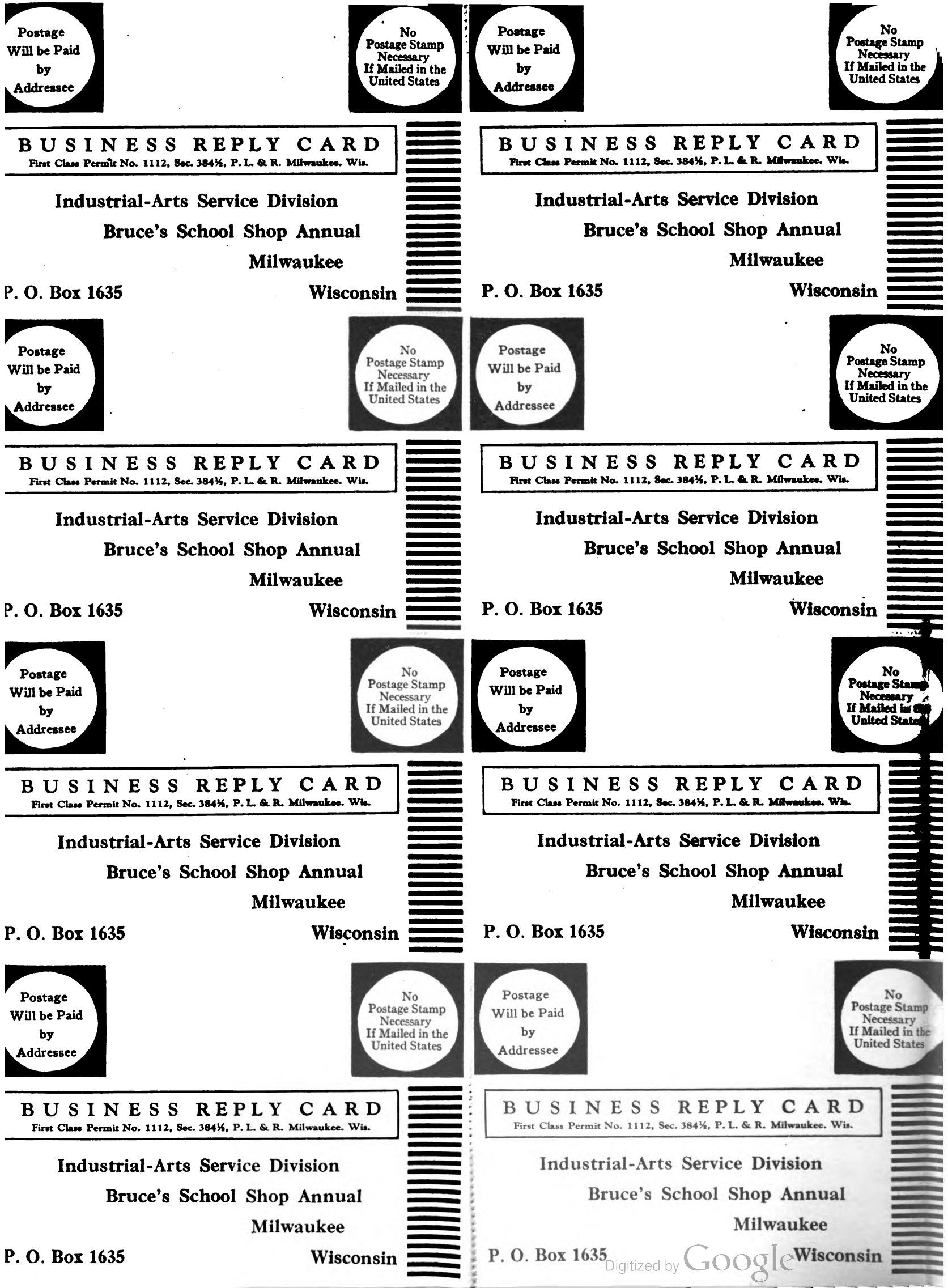
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